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ON THE FLORA OF KUWEIT : III*

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Chenopodiaceae

The genera of this family have been accepted with the limits defined by E. Ulbrich (in Engler & Prantl, Natürl. Pflanzenf. ed. 2, 16C : 379. 1934). Determinations in the family often leave much to be desired. *Chenopodiaceae* form a most important component of the vegetation of the Arabian deserts and similar areas, but their late-flowering habit means that the taxonomist is far too often confronted with immature material. There is much work to be done in this fascinating family, but progress can only be made when good collections of fertile material become available, collections that can only be made in the less comfortable months of the year.

82. Agathophora alopecuroides (*Del.*) *Bunge* in Mém. Acad. Sc. Pétersb. 7 Sér. 4, No. 11 : 92 (1862).

Salsola alopecuroides Del. Fl. Egypte, 56, t. 21, f. 1 (1812).

Halogeton alopecuroides (Del.) Moq. Chenopod. Mongr. Enum. 161 (1840).

Type. Egypt, near the Pyramids of Giza ; *Delile* (P—not seen).

Kuweit. Dibdiba ; 180 m. ; a variety of *hamdh* ; in depressions in sandy soil ; a bushy plant about 2 ft. high, close growing and well grazed down by camels ; 17 Apr. 1938, *Dickson* 456.

Distribution. Algeria, Egypt, Sinai, S. Palestine, " Arabia petraea ".

A modicum of doubt must at present be attached to this determination as Mrs. Dickson's specimen is sterile ; we have, however, been unable to find in the herbarium, any other species to which it could belong. It is to be hoped that confirmation of this record will soon be possible as it provides a new eastern limit for this monotypic genus.

83. Anabasis articulata (*Forsk.*) *Moq.* in DC. Prodr. 13, pt. 2 : 212 (1849).

Salsola articulata Forsk. Fl. Aeg.-Arab. 55, t. 8a (1775).

* Continued from Kew Bull. 1952, 352.

Type. Egypt, " in arena mobili circa Pyramides " ; *Forskal* (C !).

Kuweit. Dibdiba area, 60 miles west of Jahra ; 120 m. ; *ajeram*—a variety of *hamdh* ; it grows in this Dibdiba region on firm soil together with *rimdh* ; a smaller bush than the *rimdh* and more compact, gives a grey-green tinge to the desert and although the flowering season is in the summer some dry flowers are still on the bush ; grazed by camels ; 26 Dec. 1947, *Dickson* 561. Batin Valley, 90 miles west of Kuweit ; 240 m. ; *rimdh* ; among other *hamdh* bushes ; a large bush 2½ ft. high, covered with pink paper-like flowers, the most universal of all the *hamdh* bushes ; grazed by camels and gazelles ; 26 Nov. 1949, *Dickson* 639.

Arabia. Summan area ; 90 m. ; a kind of *hamdh*, either *ajeram* or *arad* ; growing among hills in small depressions ; height 12–16 ins., minute flowers coming from each joint ; 28 Nov. 1937, *Dickson* 397.

Distribution. Southern Spain, North Africa, Egypt, Sinai, Palestine, Transjordan.

Anabasis articulata has apparently not hitherto been recorded from Arabia. It may easily be confused with *Haloxylon salicornicum* (Moq.) Boiss. ; for the distinguishing features see under that species (p. 383).

84. Anabasis setifera *Moq.* Chenopod. Monogr. Enum. 164 (1840) et in DC. Prodr. 13, pt. 2 : 214 (1849).

Seidlitzia lanigera Post, Fl. Syr. Pal. & Sinai, 689 (1896).

Type. Persia, between Teheran and Ispahan ; *Olivier* (G—not seen).

Kuweit. E. of Batin Valley, 90 miles west of Kuweit ; 255 m. ; *shāran* ; in Dibdiba region near Batin among *rimdh* and *ajeram* ; young plant compact, juicy flower heads full of moisture, pale yellow green paper-like flowers ; eaten by camels ; 26 Nov. 1949, *Dickson* 638.

Arabia. Jubail ; 15 m. ; *gadraf* (Ajman name), a variety of *hamdh* ; growing on the rocky island known as Jabal al Bahri in the harbour ; a bushy plant with square stems and fleshy leaves which are pinky near root ; eaten by camels ; 4 Apr. 1942, *Dickson* 481. Bahrein Island, below New Camp ; globular bushes in a stony nalla ; 16 Oct. 1935, *Fernandez* 61. Bahrein Island ; 1906, *Pilgrim* s.n. Bahrein Island, sandy desert 2 miles north of Ras-el-Bar ; 5 Mar. 1950, *Good* 294. Desert south of bridge on the Awali road ; 10 March 1950, *Good* 295.

Distribution. N. Africa, Egypt, Sinai, Palestine, Persia, Baluchistan and N.W. India.

No published record of this species from Arabia has been found ; the above specimens link up collections from Palestine and Sinai with others from Persia and Baluchistan.

Olivier's specimen has been cited as the type from the account in De Candolle's Prodromus. Moquin's original description simply gave " In Aegypto, Persia " without quoting any collectors ; but the synonym " *Salsola lutea* Del. in herb " evidently accounted for the Egyptian record. However, in the Prodromus Moquin accepted Delile's plant as a distinct species, which he named *Anabasis lutea* Moq. ; in this he has not been followed by modern botanists, but it is clear that the Persian element of the

original citation, particularised as Olivier's specimen in the Prodromus, should be taken as the type of the species.

An isotype specimen of *Seidlitzia lanigera* Post collected at M-Baghik on the shore of the Dead Sea is in the Kew Herbarium. It is without flowers or fruits but agrees well with other material of *A. setifera*.

85. Atriplex dimorphostegia *Kar. et Kir.* in Bull. Soc. Imp. Nat. Mosc. 15 : 438 (1842) ; Aellen in Engl. Bot. Jahrb. 70 : 34 (1939).

Type. Kasakstan, " In salsis Songoriae ad lacus Kly prope fontem Sassyk-pastau " ; 1841, *Karelin & Kiriloff* (not seen).

Kuweit. Jahra, 20 miles west of Kuweit ; sea level ; in gardens under palm trees ; a spreading plant with milky juice in stems and with greenish flowers ; 20 Mar. 1938, *Dickson* 454. Kuweit ; sea level ; by roadside just outside town walls ; spreading plant with spade-shaped seed-pods which hang down when ripe, underside of leaves covered with crystals and to a lesser degree upperside of leaves and seeds ; 13 Apr. 1942, *Dickson* 491.

Distribution. Morocco to Afghanistan and Central Asia.

86. Atriplex leucoclada *Boiss.* Diagn. 1 Sér. 12 : 95 (1853) ; Aellen in Engl. Bot. Jahrb. 70 : 21 (1939) ; Eig in Pal. Journ. Bot. J. Ser. 3 : 123 (1945).

Type. Sinai, in valle Wadi Hamme; *Schimper* 434 (G, K !—provisional lectotype).

Kuweit. Kuweit ; sea level ; *al rughal* ; in uncultivated part of garden of Sheikh, fairly common ; a straggly low bush 8 ins. high and 1 ft. across with green fruits and minute greenish white flowers ; eaten by sheep and camels ; 28 Nov. 1934, *Dickson* 142A. Grain Island, Kuweit harbour ; sea level ; *ar rughal*, one of the *hamdh* varieties ; grows on sweet sandy soil and becomes a bush about 1 ft. high and 2 ft. across ; the leaves are slightly bitter and green and salty looking ; 2 May 1935, *Dickson* 142B. Ras Qaliya ; 18 m. ; on rocky sandstone near sea ; low thin straggly bush, flowers rose pink but only two pieces found in flower ; a variety of *hamdh* eaten by camels ; 2 Dec. 1934, *Dickson* 144. Masjan Island ; sea level ; *rughal* ; mostly along the coast of the island ; a bush with grey leaves but mostly grazed down very short ; 21 Mar. 1938, *Dickson* 440. Batin valley ; 240 m. ; *rughal*, name given by Jiblan Badawin—*manāwar* ; thin straggly plant 12–14 ins. high with salty leaves ; much eaten by camels at this time of year ; 26 Nov. 1949, *Dickson* 640.

Distribution. Egypt, Sinai, Palestine, Syria (?), Iraq, Persia, Transcaucasus and Turkestan.

Ulbrich in his treatment of the *Chenopodiaceae* made a new combination for this species under *Obione* (l.c. p. 596) but as Aellen more recently fully investigated the genus *Atriplex* we prefer to follow him and retain the plant as *Atriplex leucoclada* Boiss. Aellen distinguishes two subspecies according to the fruiting perianth. It seems that *Dickson* 640 should be referred to subsp. *leucoclada* (i.e. subsp. *eu-leucoclada* Aellen), while *Dickson* 142A in which the fruiting calyx has distinct marginal lobing and dorsal

appendages, belongs rather to subsp. *turcomanica* (Moq.) Aellen. *Schimper* 434 which has the fruiting perianth without appendages, or with only slight ones, has been determined as ssp. *eu-leucoclada* by Aellen and is selected as provisional lectotype of the species. There are at present no other characters correlated with these small fruit differences, and it is noteworthy that the occurrence of both subspecies in Kuweit has a parallel with what has already been recorded by Aellen himself for Sinai.

The Kuweit specimens are the first and only record at Kew of this species from the Arabian peninsula.

87. Bassia eriophora (*Schrad.*) *Aschers.* in Schweinf. Beitr. Fl. Aethiop. 187 (1867).

Kochia eriophora Schrad. Neues Journ. 3, pt. 2 : 86, t. 3 (1809).

Type. Not precisely designated.

Kuweit. Kuweit ; Mar. 1933, *Dickson* 61.

Distribution. Egypt, Sinai, Palestine, Transjordan, Arabia, Iraq, Persia, S. Turkestan, Afghanistan, Baluchistan.

88. Beta vulgaris *L.* ssp. **maritima** (*L.*) *Thell.* Fl. Adv. Montpell. 189 (1912) ; Aellen in Ber. Schw. Bot. Ges. 48 : 473 (1948).

B. maritima L. Sp. Pl. ed. 2, 322 (1762).

Type (of ssp.). Not precisely designated.

Kuweit. Kuweit ; sea level ; rubbish heap ; a green plant somewhat resembling spinach, with smooth juicy leaves and with green flowers growing out from the base of each leaf ; 12 Mar. 1936, *Dickson* 281.

Distribution (of ssp.). Coastal areas of Western Europe ; from the Azores along the Mediterranean coasts to N.W. India.

89. Chenopodium murale *L.* Sp. Pl. 219 (1753).

Type. Not precisely designated.

Kuweit. Arafjan ; *al warege* ; Mar. 1933, *Dickson* 21. Arafjan ; 1935, *Dickson* 21A. Kuweit ; in sandy ground, growing with *Dickson* 310 [*Astragalus* sp.] ; 25 Apr. 1936, *Dickson* 21B. Masjan Island ; sea level ; in the vicnity of fisherman's hut ; bushy with greeny red flowers ; 21 Mar. 1938, *Dickson* 441.

Arabia. Farsi Island, in the Persian Gulf 50° E. 28° N. approx. ; sea level ; green flowered plant 10 ins. high ; 17 Mar. 1950, *Lady Hay* (*Dickson* 645). Ain Najm, Hofuf ; in garden among lucerne (*jet*) ; Good King Henry, 14 ins. high, branched, flowers green ; 16 Mar. 1953, *Dickson* 729.

Distribution. Widespread as a weed throughout most parts of the world.

90. Cornulaca leucacantha *Charif et Aellen* in Verhandl. Naturfor. Gesell. Basel, 61 : 161 (1950).

Type. Persia, Salzlehmwüste beim Bahnhof " Kavir " 88 km. östl. von Teheran ; ca. 1000 m. ; 22 Aug. and 27 Sept. 1948, *Aellen* 362, 363 (Basel—not seen).

KUWEIT. Kuweit ; sea level ; sweet sandy soil ; a prickly bush with minute yellow flowers at the tips of the shoots ; 25 Oct. 1935, *Dickson* 22. Zor hills ; *shilwah* ; *Cox* 75.

Distribution. Persia and Iraq.

When this material was originally examined it was thought that, together with other similar specimens from Iraq and Persia, it must probably be referred to *C. aucheri* Moq. ; the differences observed (the closer more slender leaves and longer hairs of *C. aucheri*) seemed to be due to the specimens being in a different stage of growth. Since then, however, the material in question has been sent for examination to Dr. P. Aellen at Basle, and he has determined it as *C. leucacantha.* The investigation of these two species in the field, especially with regard to ecological preferences, is desirable, as it is noteworthy that, despite the small amount of material at present available for examination, two mixed gatherings (*Aucher* 2785 and *Guest* 4008) of *C. aucheri* and *C. leucacantha* are already known. *Cox* 75 previously recorded by Carter (in Rec. Bot. Surv. Ind. 6 : 182. 1917) as *Kochia* sp. might possibly be a seedling of *Cornulaca leucacantha* ; it is less than 2 ins. high and has needle-pointed leaves, but these are not hard and spiny as in the mature plant.

91. Halocnemon strobilaceum (*Pall.*) *M. Bieb.* Fl. Taur. Cauc. 3 : 3 (1819).

Salicornia strobilacea Pall. Reise Russ. Reich. 1 : 412 & 481, tab. B, fig. 1, 2 (1771) ; Ill. Pl. 9, tab. 4 (1803).

S. cruciata Forsk. Fl. Aeg.-Arab. 2 (1775)—teste auct. plur.

Type. Kasakstan, Lake Inderskoi ; 20 Aug. 1769, Pallas (not seen).

KUWEIT. Khadama, south bay of Kuweit ; *theluth* (a variety of *hamdh*) ; salty marshland which is covered by abnormal high tides ; a low growing plant with long shoots at the end of which appear notches and yellow stamens ; 15 Oct. 1935, *Dickson* 263. Failaka Island ; sea level ; *hamdh* ; salt pans at eastern end of island ; 20 Mar. 1938, *Dickson* 426 [very immature specimen but almost certainly this species]. Ain al Abd, 80 miles S.E. of Kuweit ; 75 m. ; in salty ground, mostly along edge of salty sulphur stream coming up from spring and running to the sea ; straggling bushes 1–1½ ft. high without flowers ; many rats living in burrows among its roots and feeding on its leaves ; 4 Apr. 1937, *Dickson* 550. Ashairiz point, 10 miles west of Kuweit town ; salty ground just above high tide mark ; similar to my No. 263 but with probably more flowers, which resemble minute specks of pollen ; 18 Oct. 1947, *Dickson* 564.

ARABIA. Jabal Amuda to Mish'āb ; on low sandy dunes along the sea-shore ; woody stem ; 7 Apr. 1949, *Dickson* 610. One mile north of Ras Mish'āb ; growing in sand along edge of shore ; green, salty, low-growing bush with minute flowers ; 4 Dec. 1950, *Dickson* 716.

Distribution. From Sardinia sparingly eastwards on the north shores of the Mediterranean ; Algeria, Egypt, Sinai, Cyprus, Iraq, Persia ; in Russia from the N.E. shores of the Black Sea to Central Asia.

The above collections, which represent the first Arabian record of this species in the Kew herbarium, are all from the N.E. corner of Arabia and link up with specimens from southern areas of Iraq and Persia.

The species is not infrequently confused with *Arthrocnemon glaucum* Ung. but that seems to be a less woody plant at the base. In the flowering stage there is no difficulty in distinguishing them, the differences (the flowers in the axils of the stem joints with the united perianth very shortly lobed and two stamens of *Arthrocnemon glaucum*, in contrast to the flowers subtended by flattened peltate bracts with the three unequal perianth segments only slightly joined at the base and single stamen of *Halocnemon strobilaceum*) being well shown in the illustrations in Ulbrich's account of the *Chenopodiaceae* (in Engler & Prantl, Natürl. Pflanzenf. ed. 2, 16C : 547, fig. 204).

92. Haloxylon persicum *Bunge ex Boiss. et Buhse* in Nouv. Mem. Soc. Nat. Mosc. 12 : 189 (1860) ; Ulbrich in Engler & Prantl, Natürl. Pflanzenf. ed. 2, 16c : 572, f. 215 A–G ; Iljin in Komarov, Fl. U.R.S.S. 6 : 311, t. 10, f. 9 (1936) ; Zohary in Pal. Journ. Bot. J. Ser. 1 : 413 (1940).

Type. Central Persia, large salt desert between Dschendak and Enarek ; Apr. 1849, *Bunge* (Leningrad—not seen).

Arabia. On road to Hofuf, S.W. of Ain Jadida ; *ghadha* (one of the 7 varieties of *hamdh* ?) ; a few solitary bushes growing near tracks of cars ; bush about 6 ft. high, fine branches some with pinkish dry leafy tips (galls) ; eaten by camels ; 23 Mar. 1947, *Dickson* 527.

Distribution. Southern Palestine, Arabia, Persia, Afghanistan, Turkestan.

There must for the present be some doubt concerning the occurrence of this species in Arabia as the specimens available for examination are of sterile material only. The type specimen has not been seen, but there are at Kew two sheets from Turkestan of *Sintenis* 1250 which is quoted by Iljin (l.c.) ; this has the acuminate leaves which seem to be characteristic of the species, although the acuminate tips are not as elongate as suggested by the illustrations of Ulbrich and Iljin. *Dickson* 527 and two other plants from Arabia, one near Aqaba and the other further south at Wadi Bisha, are all referred to the vernacular name of *ghadha* and agree in vegetative characters with the Sintenis plant ; Zohary discusses the characters and distribution of the " Ghada " tree and refers it to *Haloxylon persicum* Bge. However, until good flowering and fruiting specimens, together with corresponding vegetative material, can be examined and compared with similar material of the allied species *H. ammodendron* (C. A. Mey.) Bunge and *H. aphyllum* (Minkw.) M. M. Iljin the variations, relationships and distributions of the three species cannot be fully appreciated in the herbarium.

93. Haloxylon salicornicum (*Moq.*) *Boiss.* Fl. Or. 4 : 949 (1879).

Caroxylon salicornicum Moq. in DC. Prodr. 13, 2 : 174 (1849).

Haloxylon schmittianum Pom. Nouv. Mat. Fl. Atl. 334 (1874).

H. schweinfurthii Aschers. et Schweinf. Ill. Fl. d'Eg. 128 (1887).

Hammada salicornica (Moq.) Iljin in Journ. Bot. U.R.S.S. 33: 583 (1948).

Type. Afghanistan ; *Griffith* 1796 (K !).

Kuweit. Zor hills ; 120 m. ; a variety of *hamdh* ; growing amongst the sandstone and sandy ground ; a straggly bush about 18 ins. high with pale pinky-white paper-like flowers ; eaten by camels ; 25 Nov. 1934, *Dickson* 145. Liyah, 40 miles north of Kuweit ; 60 m. ; *hamdh* ; pebbly ground beside the Basra–Kuweit road ; a bush about 16–18 ins. high, but rather straggly and having clusters of small reddish-pink flowers along the tips of each branch ; eaten by camels ; 10 Nov. 1936, *Dickson* 320. Liyah ; 60 m. ; *hamdh* ; pebbly ground along the Basra–Kuweit road ; a more compact bush than either *Dickson* 319 [*Salsola* sp.] or *Dickson* 320, and with a mass of small greenish-yellow paper-like flowers, and extra juicy stems ; eaten by camels ; 10 Nov. 1936, *Dickson* 321. Zor hills ; *Cox* 27.

Arabia. South of Abqek oil field ; *rimdh* (*hamdh*) ; sandy country along track into Hasa ; bush about 2 ft. high just sending out green or pink young shoots ; eaten by camels as salt bush ; 23 Mar. 1947, *Dickson* 524. West of Jubail on tapline road ; 90 m. ; one of the varieties of *hamdh* probably *rimdh* ; sandy country ; eaten by camels for salt fodder ; 7 Apr. 1949, *Dickson* 580 B.

Distribution. Algeria to Egypt, Sinai, Palestine, Transjordan, Arabia, Iraq, Persia, Afghanistan, Baluchistan and N.W. India.

Haloxylon salicornicum and *H. schweinfurthii*, which have been retained as separate species by Ulbrich (with the distribution of the former being North Africa, Persia and N.W. India and of the latter Egypt to Arabia), seem to be indistinguishable from one another. Examination of the available herbarium material does not show any variation which would warrant recognition of a second species, and the distribution becomes combined into a continuous geographical range. The Arabian material consists of flowering and fruiting specimens and also of sterile vegetative plants, the young branches of which are fine, green and fleshy. As in the previous species *H. persicum* Boiss. et Buhse, insect attack sometimes causes gall formation and irregular leaf development.

Haloxylon salicornicum has been readily confused with *Anabasis articulata* (Forsk.) Moq. and superficially they are remarkably alike in the herbarium ; the species, however, may be distinguished on the following characters :—in *Anabasis articulata* the seed is vertical and the membranous staminodes are orbicular-oblong with obtuse almost truncate, thickened, opaque tips, while in *Haloxylon salicornicum* the seed is horizontal and the staminodes are entirely thin and membranous, narrowly oblong-elliptic with acute tips. Vegetatively the thicker more fleshy shoots of the *Anabasis* are distinctive, once one has become familiar with both species.

Having decided to adhere to Ulbrich's arrangement of the genera, we treat this plant as a species of *Haloxylon* ; but more recently Iljin has placed it, together with several other species, in a new genus *Hammada*.

94. Kochia *sp.*

Kuweit. Grain Island ; sea level ; stony ground on island ; a silvery leaved plant with a woody stem and no apparent flowers ; 30 May 1935, *Dickson* 229.

This plant is sterile, but from general habit and indumentum characters appears to be a species of *Kochia*, probably near *K. cana* Bunge.

95. Salsola baryosma (*Roem. et Schult.*) *Dandy* in Andrews, Fl. Pl. Angl.-Egypt. Sud. 1 : 111 (1950).

S. foetida Del. Fl. Aeg. Ill. 57, No. 310 (1812)—*nomen nudum* ; Boiss. Fl. Or. 4 : 961 (1879) ; *non S. foetida* Pall. in Roem. et Schult. Syst. Veg. 6 : 238 (1820).

Chenopodium baryosmon Roem. et Schult. Syst. Veg. 6 : 269 (1820).

Caroxylon foetidum Moq. in DC. Prodr. 13, 2 : 178 (1849).

Type. Egypt, Tentyra [Denderah] ; *Sieber* (?, K !).

Kuweit. Kuweit, uncultivated part of Sheikh's garden ; sea level ; *gaghraf*, a variety of *hamdh* ; common, it seems to dry up with the first cold weather and is a low growing very juicy plant, the shoots being pink towards the tip, the juice has a nasty smell and the flowers are paper like and dry ; 28 Nov. 1934, *Dickson* 143. Same locality ; 1935, *Dickson* 143A.

Distribution. Scattered localities in North Africa from Morocco and Senegal to Egypt and Sudan ; Sinai, Arabia, S. Persia, Afghanistan, Baluchistan, N.W. India.

As *Salsola foetida* Del. was published without description the earliest name for the above plant is *Chenopodium baryosmon* Roem. et Schult. Specimens from tropical Africa previously identified and recorded as *S. brevifolia* Desf. (1798) suggested that this species might be conspecific with *S. baryosma*, but Maire has shown (Cat. Pl. Maroc. 2 : 188. 1932 ; 4 : 974. 1941) that *S. brevifolia* is a distinct plant from West Mediterranean countries and is synonymous with *S. vermiculata* L. var. *microphylla* Moq. ; the misidentified plants from tropical Africa are in fact *S. baryosma*.

96. Salsola jordanicola *Eig* in Pal. Journ. Bot. J. Ser. 3 : 130 (1945).

Type. Palestine, Wadi Kelt ; 6 Oct. 1928, *Gabrielith* 126 (Jerusalem, K !—provisional lectotype).

Kuweit. Fantas ; sea level ; growing amongst tomatoes in sweet sandy soil ; a plant 8 ins. high with minute, pale whitey-blue flowers ; 23 Mar. 1935, *Dickson* 216. Kuweit ; sea level ; a variety of *hamdh* ; growing inside town walls on sweet soil ; a bushy plant with juicy round green buds all along the stem and pale pink and greeny-yellow paper-like fruits each on a separate bush ; 28 Oct. 1935, *Dickson* 265.

Distribution. Palestine.

This species has previously been represented at Kew only by specimens from Wadi Kelt in Palestine and those, together with collections of Eig and Zohary, from Kallirhoe in 1925, and from the east of Damascus and west of Rutbah in 1933, are quoted under the original description without designation of a holotype. The distribution given by Eig is Palestine, Southern Syria and the extreme west of Iraq ; *Dickson* 265 with farinose stems and bracts, and with persistent bracteoles extends the record of distribution eastwards to the Persian Gulf. The material includes

branches of 36 cm. in length giving a somewhat taller plant than the 15 to 30 cm. of those originally described. *Dickson* 216 is a vegetative specimen which has branches farinose, leaves linear, dilated at the base and covered with a spreading indumentum of long hairs. These characters and the erect much branched habit suggest that it is probably *S. jordanicola*.

97. Salsola vermiculata *L.* var. **villosa** *Moq.* Chenop. Monogr. Enum. 141 (1840) et in DC. Prodr. 13, 2 : 181 (1849).

S. villosa Del. Fl. Aeg. Ill. 57, No. 309 (1812)—*nomen nudum* ; non *S. villosa* Roem. et Schult. Syst. Veg. 6 : 232 (1820).

S. vermiculata L. ssp. *villosa*. (Moq.) Eig in Pal. Journ. Bot. J. Ser. 3 : 132 (1945).

Type (of var.). Egypt ; Delile (P—not seen).

Arabia. Wadi Arar ; 450 m. ; *rowdha* ; growing all up the valley ; small shoot with pink stems of much broken woody bush used for fire-wood ; apparently a well known salt bush and good fuel in these parts ; 18 Apr. 1950, *Dickson* 680.

Distribution (of var.). Egypt, Syria, Palestine, Iraq, Persia.

There is some doubt concerning the determination of the above specimen as it consists only of a sterile fragment. The type specimen has not been seen, but *Dickson* 680 agrees with the vegetative parts of other collections from Egypt. *S. villosa* Delile was a *nomen nudum* ; but Moquin gave a brief description for his variety *villosa* quoting Delile's specimen as the type. More recently Eig has placed *villosa* as a subspecies of *S. vermiculata* ; Eig actually wrote " *S. vermiculata* ssp. *villosa* (Del.) Eig (= *S. villosa* Del.)", and, as *S. villosa* Del. is a *nomen nudum*, it might be thought that the name should be rejected. However, reference is made in the notes to Moquin's treatment of the plant as a variety of *S. vermiculata* and it therefore seems reasonable to regard the subspecies as being based on that. As the material in the Kew herbarium is rather incomplete it is most satisfactory to retain it under Moquin's varietal status until further data can be obtained.

The Arabian locality is in the north near the border with Iraq, and it will be interesting to examine flowering and fruiting material to confirm the distribution of the plant into this country.

98. Salsola *sp.* nearest to *S. hierochuntica* Bornm. in Beih. Bot. Centr. 29, 2 : 13 (1912) and *S. subaphylla* C. A. Mey in Eichw. Pl. Casp.-Cauc. 34, t. 24 (1833).

Kuweit. Liyah, North of Kuweit ; 60 m. ; *hamdh* ; pebbly ground along the Basra–Kuweit road ; a bush about 18 ins. high the branches of which are covered with round paper-like flowers of a yellowish-green colour ; extensively eaten by camels ; 10 Nov. 1936. *Dickson* 319.

This plant does not appear to have been previously represented in the Herbarium at Kew. In general appearance it approaches *S. hierochuntica* Bornm. from Palestine, Southern Syria and Iraq, but this has bracts and bracteoles acute, cone of the fruiting perianth hispid and branches pubescent, while *Dickson* 319 has bracts and bracteoles short and obtuse,

cone of the fruiting perianth finely papillate and branches pubescent. *S. subaphylla* C. A. Mey. an allied species, has short bracts and bracteoles, the cone of the fruiting perianth is glabrous and the branches are also completely glabrous ; distribution is from Iraq, Persia and Afghanistan to Turkestan. The variations seem to warrant specific, or at least varietal distinction for the Kuweit plant and it is hoped that further material may become available to confirm the position.

99. Seidlitzia rosmarinus *Bunge ex Boiss.* Fl. Or. 4 : 951 (1879).

Salsola rosmarinus (Bunge ex Boiss.) Eig in Pal. Journ. Bot. J. Ser. 3 : 132 (1945).

Type. N.W. Arabia, island of Maksuk ; Aug. 1820–26, *Ehrenberg* 123 (B.K !).

Kuweit. Ain al Abid ; sea level ; *shinān* ; in vicinity of sulphur spring growing in the salty ground amongst *turafa* [*Tamarix passerinoides*] and some *suard* [*Suaeda vermiculata*] bushes, abundant but not seen in any other district yet by me ; a low growing bush, the old leaves of which appear quite white and give the appearance of being encrusted with salt, no flowers visible now ; the dried and pounded leaves are used for washing bedouins' clothes, hair, etc. and make a lather like soap ; 10 Jan. 1935, *Dickson* 152. Masjan Island ; sea level ; *shinān* ; all over the island on sweet sandy soil ; a bush about 12 to 18 ins. high with green rather fleshy leaves ; 21 Mar. 1938, *Dickson* 442.

Arabia. Saffaniya, 20 miles south of Ras Mish'āb (tapline port) ; sea level ; variety of *hamdh* ; growing on shore just above high tide mark ; green branched salty bush resembling *hurrm* [*Zygophyllum* sp.] but with paper-like circular fruits ; 3 Dec. 1950, *Dickson* 715. Bahrein Islands ; dunes of Ras-al-Barr ; 5 Mar. 1950, *Good* 286.

Distribution. Palestine, Transjordan, Arabia, Iraq, Persia.

Until recently much of the available material of this species was determined as *Salsola longifolia* Forsk.*, but examination has shown that the latter is an Egyptian species synonymous with *Salsola sieberi* Presl, and does not extend further eastwards. *Seidlitzia rosmarinus* has quite a separate distribution from Palestine to Persia, with the herbarium records showing its occurrence along the eastern Arabian coast as far south as the Bahrein Islands. No specimens have been seen from Afghanistan and Turkestan where the species is also said to grow.

Seidlitzia rosmarinus and *Salsola longifolia* are very similar superficially having opposite fleshy leaves and winged outgrowths arising above the middle of the emarginate perianth parts. Dr. M. M. Iljin (Leningrad) informs us that he is revising the genus *Seidlitzia* and that both plants will be accepted as species of *Seidlitzia*. Pending the publication of this detailed work it is sufficient to show that although the plants appear to be closely allied they have several distinct characters. Thus *Seidlitzia rosmarinus* has leaf bases almost completely joined at the nodes with no longitudinal channel down the internode, a dense tuft of white hairs in the axil of each leaf, and perianth parts and wings unequally developed in

* *Salsola longifolia* Forsk. Fl. Aeg.-Arab. 55 (1775).
Syn. *S. sieberi* Presl, Bot. Bemerk. 108 (1844).

each flower, the wings overlapping and the upper part of the perianth broad at the base somewhat obtuse to the emarginate tip, while *Salsola longifolia* has leaf bases distinct with a longitudinal channel down each side of the internode from between the leaf bases, short sparse hairs in the axil of the leaf, and perianth parts and wings equally developed in each flower, the wings orbicular and more openly overlapping, the upper part of the perianth narrower at the base and more acute at the tip than in *Seidlitzia rosmarinus*.

Eig. in his revision of the Palestine *Chenopodiaceae*, merged *Seidlitzia* with *Salsola*, and attributed the combination *Salsola rosmarinus* to Solms-Laubach in Bot. Zeitung, 11 : 171. 1901, but though Solms-Laubach stated that he could find no difference between the two genera he did not actually make the transfer.*

100. Suaeda vermiculata *Forsk. ex J. F. Gmel.* Syst. Nat. ed. 13, 2 : 503 (1791).

S. vermiculata Forsk. Fl. Aeg.-Arab. 70, t. 18B (1775)—*nomen illegitimum*.

Type. Egypt, Alexandria ; October, *Forskal* (C–not seen).

KUWEIT. Ain al Abid ; *suard*, one of the varieties of *hamdh*—a salty bush needed by camels ; growing on edge of hot sulphur spring 80 miles south of Kuweit in midst of vast salt marsh, but not common in Kuweit territory ; a bush about 18 ins. high and 2 ft. across with thick fleshy green leaves ; eaten by camels ; 10 Jan. 1935, *Dickson* 153.

ARABIA. 1 mile north of Ras Mish'āb ; sea level ; *suad* ; growing with *Halocnemon strobilaceum* along shore ; 4 Dec. 1950, *Dickson* 717.

Distribution. Canary Islands, Algeria, Egypt, Palestine, Transjordan, Arabia, Iraq.

Forskal's publication of this and several other species of *Suaeda* was invalid as he gave no separate generic description. Brenan has shown in Turrill & Milne-Redhead, Fl. Trop. E. Afr. Chenopod. 21. 1954) that the earliest legitimate publication of the genus was by Scopoli Introd. Hist. Nat. 333 in 1777 ; the specific combination appears to have been made originally by Gmelin in 1791, but Forskal's plant still remains the type specimen.

101. Suaeda *sp.*

KUWEIT. Masjan Island ; sea level ; *daar* ; a salty edible plant with fleshy leaves and pink stems ; sold in Kuweit bazaars ; 21 Mar. 1938, *Dickson* 446.

*Attention may also be drawn to a point of nomenclature concerning another species of *Salsola* in Dr. Eig's paper. He cites " *Salsola schweinfurthii* Solms-Laubach app. Eig " and gives a latin description. The specimens he enumerates are all of his own collecting in Palestine : there is no evidence that he ever saw the Schweinfurth plant to which Solms-Laubach first applied the name Bot. Zeitung, 1901, 173–174). Solms-Laubach gave no formal description, which no doubt accounts for Eig's citation, but we have read his original paper and there is sufficient descriptive matter in the text to validate the name. This is important not only because Eig's description came after a lapse of 44 years, but because, had Solms-Laubach not validated the name, the type would have had to be chosen from amongst Dr. Eig's Palestinian plants. As it is the species should be cited as *Salsola schweinfurthii* Solms-Laubach and the type is Schweinfurth's plant from Wadi Dugla, near Cairo.

This specimen, which is sterile, possibly belongs to the section *Schanginia* but flowering and fruiting material with adequate field notes is necessary for determination of the species.

102. Suaeda *sp.*

Kuweit. Kadhima, south of bay of Kuweit ; sea level ; *hartabeel* ; salty ground along coast ; a bushy plant about 2 to 3 ft. high with thick fleshy leaves and small green round flowers, nearly all plants were in bloom ; salty taste, eaten when young by Persians, also sold in bazaars ; 15 Oct. 1935, *Dickson* 262A.

This appears to be a species of *Suaeda* but has not been identified with any other specimens at Kew. The ovule is horizontal with a flat coiled embryo and the flowers are sessile in axillary spikes of 6 to 8, each flower subtended by a small membranous bract and a pair of bracteoles. The leaves, however, are up to 20 mm. long by 6 mm. broad in the dried condition and are distinctly larger than in any of the species examined. Good fruiting material may help to establish the position of this plant.

Tamaricaceae

103. Tamarix aphylla (*L.*) *Karst.* Deutsch. Fl. 641 (1880–83).

Thuya aphylla L. Cent. Pl. 1 : 32 (1755), et in Amoen. Acad. 4 : 295 (1759), et Sp. Pl. ed. 2, 1422 (1763).

Tamarix orientalis Forsk. Fl. Aeg.-Arab. 206 (1775).

T. articulata Vahl, Symb. Bot. 2 : 48, t. 32 (1791) ; Bunge, Tent. Gen. Tamar. 73 (1852) ; Gutmann in Pal. Journ. Bot. J. Ser. 4 : 47, 51 (1947).

Type. Egypt (Linn !).

Kuweit. Kuweit ; *ithel* ; sea level ; a tall tamarisk tree growing in Kuweit town and all villages on the coast, " Jahara " especially ; 10 Oct. 1935, *Dickson* 315.

Arabia. Regab ; a tree grown abundantly in the gardens around Regab apparently for house rafters ; 1865, *Pelly*.

Distribution. From Morocco to Egypt, Sudan, Somaliland, Sinai, Palestine, Arabia, Persia, Afghanistan, N.W. India.

In most of the material of this species at Kew the leaves are abruptly and shortly mucronate with the tips close against the stem, but in some specimens including *Dickson* 315 many of the leaves are much longer and acute and often project away from the stem although the greater lower portion of the leaf is still sheathing. Those leaves which subtend a flower are even more acutely pointed and always project from the stem to allow space for the flower. In the type specimen most of the leaves are shortly mucronate and close to the stem, and the material appears to be completely sterile. Forskal's type of *T. orientalis*, consists of five sheets of material and includes some flowering branches ; it matches the type of *Thuya aphylla* and Mrs. Dickson's plant.

104. Tamarix florida *Bunge*, Tent. Gen. Tamar. 37 (1852) ; Gorschk. in Fl. U.R.S.S. 15 : 306 (1949).

Type. Not precisely designated.

Arabia. Jabal Qara–Hofuf (Hasa Province) ; growing in salty patch at foot of Jabal ; dwarf tamarisk bushes, some with yellowish flowers others with pinky white ; also the pink *turafa* with them ; 23 Mar. 1947, *Dickson* 526.

Distribution. Iraq, Persia, Turkestan.

Bunge separates *T. florida* into five varieties and lists several specimens, some of which he designates to these varieties ; but there is no indication of any one plant being the holotype of the species. Gorschkowa includes four of the varieties as synonyms under *T. florida*, but the material available for examination at Kew shows some of the variations which Bunge describes.

Dickson 526, the first record of the species from Arabia, has characters which correspond to Bunge's var. *rigida* ; he quotes two specimens, both collected by Buhse, from Dshendak and from Husseinon near Rischma in central Persia, but neither of these has been seen. *T. florida* like *T. jordanis* Boiss. from Palestine bears its flowering racemes on woody branches and occasionally on young green shoots. *Kotschy* 157 from Dalechi quoted by Bunge as var. *kotschyi* is represented in the Kew herbarium ; it has lax racemes of up to 3 cm. long with the flowers, although in bud, on pedicels as long as or longer than the bracts and quite separate from one another. *Dickson* 526, however, has somewhat shorter and distinctly denser racemes in bud, which expand only slightly in flower and the pedicels are shorter than the bracts. The material included under *T. florida* has lanceolate to broadly ovate-acute, amplexicaul or subamplexicaul leaves, decurrent at the base and those on the more woody branches are distinctly pitted ; the bracts are ovate-acute with membranous margins and differ from the lanceolate to oblong ones of *T. jordanis*.

In *Dickson* 526 the petals are ovate, 1·5 mm. long by 1 mm. broad (they are ovate-oblong, 1·75 mm. long by 0·75 mm. broad in *Kotschy* 157), and the disc at the base of the ovary is equally or unequally five to ten lobed ; the shape and size of the lobes varies even on one disc so that they may be five, equal, truncate to emarginate or unequal emarginate to equally ten lobed (Bunge notes under var. *rigida* " *discus* . . . . *subaequaliter* 10 *crenatus*, *in alabastro vero profundius* 5 *lobus*, *lobis emarginatus* "). The stamens arise between the lobes and the anthers are not apiculate. The ovary is flask-shaped with 3 obovate short styles less than half the length of the ovary in the flowering stage.

These characters agree with the detailed description which Bunge gives for var. *rigida* and study of a wider range of specimens may help to show whether the features are constant enough for recognition of this and other varieties.

105. Tamarix passerinoides *Del. ex Desv.* in Ann. Sci. Nat. 4 : 349 (1825) ; Bunge, Tent. Gen. Tamar. 77 (1852).

T. passerinoides Del. Fl. Aeg. Ill. 58 (1812)—*nomen nudum.*

T. passerinoides Desv. var. *macrocarpa* Ehrenb. in Linnaea 2 : 276 (1827).

T. pycnocarpa DC. Prodr. 3 : 97 (1828) ; Bunge, l.c. 79.

T. macrocarpa (Ehrenb.) Bunge, l.c. 79.

Types. Egypt, Fayoum ; *Jomard.* Terraneh ; *Redouté* (P—not seen).

Kuweit. Arafjan ; *turafa*, dwarf tamarisk ; Mar. 1933, *Dickson* 50. Swamps at Arafjan, also at Ain al Abid ; sea level ; *turafa* ; grows in salty marshy ground generally in largish raised clumps which never seem to exceed 3½–4 ft. high as they are always being eaten or cut for firewood ; a dwarf tamarisk with long heads of many pink flowers with five petals and darker pink stamens and pink cone shaped fruits, eaten by camels and used as firewood sometimes ; 5 Jan. 1935, *Dickson* 148.

Distribution. Egypt, Sinai, Arabia, Iraq, Persia, Afghanistan, Transcaspia.

T. passerinoides, generally attributed to Delile, was published only as a *nomen nudum* but was later taken up and described by Desvaux.

Bunge accepts three species, but investigation of the material available in the Kew herbarium seems to indicate that there is only one which, although it is variable in detail, is constant in general character. The proportion in length of the pedicel to the bract which Bunge used in distinguishing *T. macrocarpa* from *T. passerinoides* and *T. pycnocarpa* has been seen to vary on the same plant and is of no specific value, while as Boissier noted (Fl. Or. 1 : 779. 1867) the characters of sepal shape and style length that Bunge used in separating *T. passerinoides* and *T. pycnocarpa* are not constant.

In the material examined the stamens and ovary have been found to be the most variable. At one extreme *Schweinfurth* 361 and *Ogilvie* both from Egypt, and *Bunge* from Hamun in Persia all have ten fine filiform stamens, with definitely apiculate anthers, while in *Schweinfurth* 361 the ovary is globose and in the others it is pyramidal. *Aucher* 4509 from Persia and *Androssow* from Transcaspia (the latter determined as *T. pycnocarpa*) have ten stamens less definitely apiculate and with shorter filaments, broad at the base tapering to the anthers. In some of the other specimens examined there is an increase in stamen number ; *Guest* 480 and *Guest* 1638 from Iraq have 12–13 stamens with relatively fine filaments and scarcely apiculate anthers. Of the Kuweit material *Dickson* 50 has 10–11 stamens very minutely apiculate ; in *Dickson* 148 it has been noted that on the sheet from Arafjan the flowers have only ten stamens with the anthers definitely but minutely apiculate, while in the specimen from Ain al Abid there are 12–15 stamens, minutely or not at all apiculate ; in all this material the filaments are broad at the base tapering upwards. Throughout the series the ovary shows various stages from flask shaped to pyramidal and the style may be short or none, but there is no correlation of this with the stamen number.

The specimens from Kuweit quoted above might be referable to var. *macrocarpa* Ehrenb., as also much of the other material at Kew. The flowers and fruits are somewhat larger than in specimens such as those of *Schweinfurth* and *Ogilvie* (petals 3·5–4·5 mm. long as against 3–3·5 mm. long and fruits 10–11 mm. long as against 6–8 mm. long) and there seems to be a certain amount of correlation of this with the larger number of stamens, broader at the base and not noticeably apiculate, but this is not constant and there is no real evidence of grouping of characters sufficient even for varietal rank.

The three species of *Tamarix* from Arabia, listed above, may be distinguished by the following characters:—

Leaves sheathing, abruptly mucronulate, pitted, bases completely encircling the stem and leaf-scars forming a complete circle ; flowers subsessile, bracts longer than very short pedicels ; flowers 1·5–2·5 mm. across, fruits 2·5–4 mm. long ; stamens 5 in number. *T. aphylla*

Leaves subamplexicaul, bases not completely encircling the stem, although often clasping well around it, leaf scars not forming a complete circle ; pedicel about equal to calyx, bracts sometimes longer, often equal to or shorter than pedicels.

Leaves on green shoots lanceolate to ovate-acute, pitted ; flowers 2–2·5 mm. across, fruits 2·5–4 mm. long ; stamens 5 in number, disc 5–10 lobed. *T. florida*

Leaves on green shoots ovate-acute to deltoid, markedly pitted ; flowers 7–8 mm. across, fruits 6–11 mm. long ; stamens 10–15 in number, disc 10–15 lobed. *T. passerinoides*

MALVACEAE

106. Malva parviflora *L.* Amoen. Acad. 3 : 416 (1756), et Sp. Pl. ed. 2 : 969 (1763).

Type. Hort. Ups. (Linn ! Two specimens—see notes below).

KUWEIT. Around Kuweit ; *khubezi, al khubaiz* ; Mar. 1933, *Dickson* 72. Subaihiya wells ; sea level ; well manured ground in vicinity of wells ; a mallow with white flowers, possibly a variety ; 17 Mar. 1937, *Dickson* 324. From the neighbourhood of Kuweit ; 1865, *Pelly*. Without locality or number, *Cox* [sterile].

ARABIA. Dubai, Oman coast, Persian Gulf ; 3–4 m. ; under thorn tree on limestone covered sandy ground ; single growth, pale pink flower, only specimen seen ; 10 Mar. 1937, *Holmes* (*Dickson* 333 H). Ain Najm, Hofuf ; among lucerne beds ; mallow with a single stem 18 ins. tall, and pale almost white flowers ; 16 Mar. 1953, *Dickson* 730.

Distribution. Canary Islands, countries bordering the Mediterranean, through Iraq and Persia to N.W. India ; Abyssinia, Sudan and S. Africa ; in Australasia, America and British Isles, probably as an introduced plant.

The two sheets in the Linnean Herbarium show some of the variation found in this species. Most of the Arabian specimens are well matched by the Linnean sheet No. 16, which is marked HU. The calyx is 8 mm. across and the fruits have a distinct pedicel, while the leaves are not deeply divided and the lobes are obtuse. Sheet No. 17, however, has a large leafy calyx 12 mm. across, the fruits are almost sessile with the carpels hairy and somewhat wavy at the margins, and the leaves are much more distinctly angled than those of the first specimen. Plants in the Kew herbarium which most resemble sheet No. 17 are represented by *Tengwall* 474 from Asia Minor and by *Dickson* 730 from Arabia. As the original description is insufficient to easily designate either one of these specimens

as lectotype, this is best left undecided until a more detailed research of the species has been carried out.

var. **cristata** *Boiss.* Fl. Or. 1 : 821 (1867).

Type (of var.). Lower Egypt ; *Kralik*. Persia, Mohammera ; *Noë* (G—not seen).

Kuweit. Masjan Island ; sea level ; *khubaiz* ; mostly surrounding the only inhabitant's house ; mallow, flower pale mauve ; 21 Mar. 1938, *Dickson* 439.

Distribution (of var.). Scattered specimens from France, Morocco, Algeria and Persia.

Boissier's var. *cristata* is separated in the Kew herbarium from small fruited specimens under the name of var. *microcarpa* (Desf.) Loscos. This combination is in general use for plants from the Mediterranean and alien in Great Britain. *M. microcarpa* Desf. (Tabl. ed. 1 : 144. 1804), however, is a *nomen nudum* ; without reference to Desfontaines the epithet was first given a description by Persoon (Syn. Pl. Ench. Bot. 2 : 251. 1807) but it is too brief to impart a distinctive idea of his plant. Boissier quoted *M. microcarpa* Desf. as a synonym of var. *cristata* and until the type specimens of Desfontaines, Persoon and Boissier can all be examined the relationships of these plants cannot be worked out. We have been unable to trace the original reference to the combination var. *microcarpa* (Desf.) Loscos, which is mentioned by Hegi (Fl. Mitt.-Eur. 5, 1 : 477. 1925) and for which Jahandiez & Maire (Cat. Pl. Maroc. 4 : 1070. 1947) give the date as 1877.

107. Malva verticillata *L.* Sp. Pl. 689 (1753) **forma floribus et fructibus minoribus.**

Kuweit. Kubba Island in the Persian Gulf, 40 miles from Kuweit town ; sea level ; mallow with pale pinky mauve flowers growing everywhere ; 17 Mar. 1950, *Lady Hay* (*Dickson* 642). Farsi Island, Persian Gulf (approx. 28° N. 50° E.) ; sea level ; tall plant nearly 18 ins. high with fruits which resemble small hollyhock ; 3 Mar. 1950, *Lady Hay* (*Dickson* 647). Specimens cultivated at Hort. Bot. Reg. Kew from *Dickson* 647, K. 3349.

These plants represent an interesting annual mallow which is apparently best referred to *M. veticillata* although by no means typical of that species. The preceding species (*M. parviflora* L.) is known to have a small fruited variety, var. *microcarpa* (Desf.) Loscos, and it may be that the above material bears an analogous relation to *M. verticillata*. Further speculation on this however, is not worthwhile without a detailed study of the species as a whole.

Hooker (in London Journ. Bot. 6 : 257. 1847) discussed a small annual plant found in a cornfield in South Wales and referred it to *M. verticillata* as an alien. He noted the absence of angles to the margins of the carpels and an elevated dorsal line with lines radiating to the margins. The outstanding features of the Kuweit plant are the small pale pinky mauve flowers and the minute carpels of 1 mm. width across the dorsal surface (Fig. 6). It has been grown on from seed at Kew

for two years and remains small (reaching to 6 ins. in height) under our conditions. Only one specimen in the Kew herbarium seems to agree closely with this plant, namely parts of a N. Asia sheet from Ircutia. From *M. parviflora* var. *microcarpa* it differs in erect habit, calyx less open in fruit and less reticulate carpels more rounded at the edges.

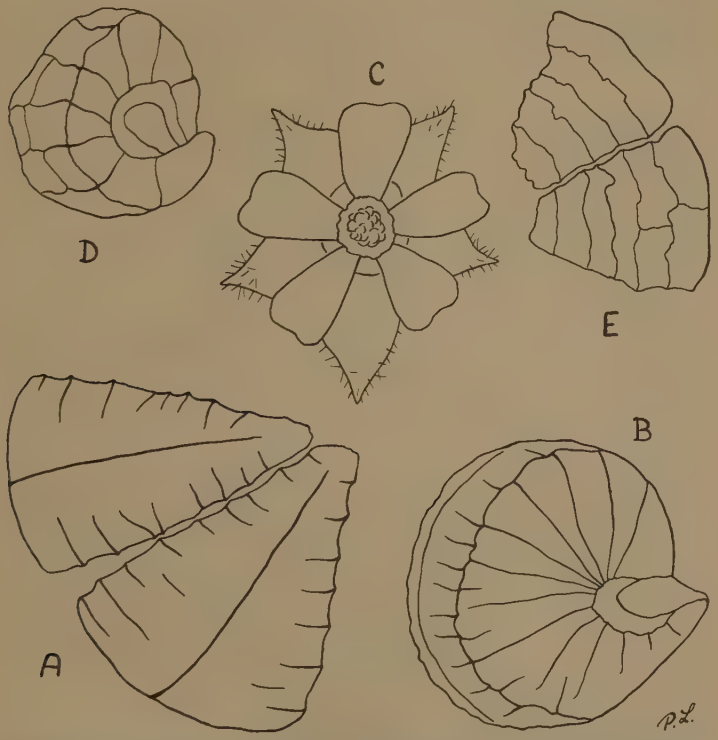

FIG. 6. *Malva verticillata* L. A. Dorsal view of carpels ; B. Lateral view of same. × 24. *Forma floribus et fructibus minoribus*. C. Flower from above. × 8. D. Lateral view of carpels ; E. Dorsal view of same. × 24.

TILIACEAE

108. Corchorus trilocularis *L.* Mant. [Prima] 77 (1767).

Type. Arabia ; *Forskal* ; cult. in Horto Upsaliensi (Linn !).

ARABIA. Gardens at Riyadh, also in Hedjaz ; 660 m. ; *mulachiyeh* ; under palm trees in gardens ; flower said to be yellow by Hedjaz servant ; eaten with meat in the Hedjaz ; 24 Oct. 1937, *Dickson* 381.

Distribution. Cape Verde Islands, Tropical and South Africa. Cyprus, Egypt, Palestine, Arabia, Iraq, Afghanistan, Baluchistan, India.

There are two specimens in the Linnean herbarium, the first is in fruit and the second labelled HU [Hortus Upsaliensis] is in flower.

LINACEAE

109. Linum usitatissimum *L.* Sp. Pl. 277 (1753).

Type. Not precisely designated.

KUWEIT. Kuweit ; sea level ; in gardens, but not cultivated in Kuweit ; blue Linum ; seed is sold for medicinal purposes in bazaar ; 10 Apr. 1936, *Dickson* 307.

Distribution. Widely cultivated and not known in a truly wild state.

ZYGOPHYLLACEAE

110. Fagonia bruguieri *DC.* Prodr. 1 : 704 (1824) ; Boiss. Fl. Or. 1 : 905 (1867).

F. echinella Boiss. Diagn. 1 Sér. 8 : 123 (1849).

Type. Bagdad–Aleppo ; *Olivier & Bruguière* (G—not seen).

KUWEIT. Arafjan ; *al jemba* ; sandhills ; Mar. 1933, *Dickson* 80. Zor Hills ; Cox 23.

ARABIA. Abu Hadriyeh Oil Camp ; 75 m. ; sandy ground inside camp area ; spreading plant with finer leaves than 554, similar but smaller pale mauve flowers and smaller fruits ; 4 May 1947, *Dickson* 555. Stony places in the neighbourhood of Regab ; 1865, *Pelly*.

Distribution. Egypt, Sinai, Palestine, S. Iraq, S. Persia, Baluchistan.

Boissier, Muschler and others use the character of the stem as the distinguishing feature for the two main groups of the genus *Fagonia*. The division is made on stems being four sided and sulcate in comparison with stems terete and striate. Examination of *F. bruguieri* however, which has been placed in the first of these two groups, shows that the stem is in fact triangular in cross section, distinctly ridged on one angle and deeply sulcate on the opposite surface, that is the upper one when the branches are prostrate. Species which come into the other group have the sulcate surface, but it is not nearly so deeply marked, and the rest of the stem is rounded with more or less equal striations.

Due to the shortness of the internodes *F. bruguieri* appears to have numerous fruits in comparison with the size of the plant ; there is usually a single small fruit at each node and the closer are the nodes the denser appear the fruits. Boissier's *F. echinella* typified by his collection from Egypt, between Cairo and Suez, has longer internodes and longer spines (up to 20 mm. long) than the general range of *F. bruguieri* (5–10 mm. long), but in other characters the plant seems to be the same.

Further discussion on this species is given below under *F. myriacantha*.

111. Fagonia glutinosa *Del.* Fl. Egypte 86, t. 28, f. 2 (1812) ; Boiss. Fl. Or. 1 : 904 (1867).

Type. Cairo ; *Delile* (P—not seen).

KUWEIT. Arafjan ; sandhills ; 1935, *Dickson* 80 A. Arafjan and Kuweit ; sea level—60 m. ; sandy ridges ; prostrate variety of No. 80 [*F. bruguieri* DC.], the purple flowers emit a lovely scent in the early morning and close about 10.30 a.m. until sunrise ; June 1935, *Dickson* 223. Arafjan ; June 1935, *Dickson* 223 A. Kuweit ; sea level ; hard

pebbly ground outside town wall ; flowers pale mauve and fruits on underside of branches, probably similar to 554 found on Abu Hadriyeh ; 15 Apr. 1947, *Dickson* 556. Kuweit, outside town wall ; sea level ; hard clay ground ; creeping plant with mauve flowers and spiked fruits ; 28 Mar. 1951, *Dickson* 721.

Arabia. Abu Hadriyeh Oil Camp, 168 miles south of Kuweit town ; 75 m. ; sandy ground in camp area ; flat spread out plant with sweet smelling pale mauve flowers on upper surface of branches and fruits hanging on under surface ; 4 May 1947, *Dickson* 554.

Distribution. Morocco, Algeria, Libya, Egypt, Sinai, Palestine.

Mrs. Dickson's specimens give the first record, in the Kew herbarium, of this species extending eastwards into Arabia. *Dickson* 80 A is a low compact plant with branches reaching to about 5 inches ; it is in the early flowering stage and is distinctly glutinous. *Dickson* 223, 554 and 556 are all specimens of prostrate glutinous plants with branches extending horizontally to a foot from the main central axis, and with the fruits in a ripe condition. *Dickson* 223A meanwhile, which also has these long trailing branches, although it is well provided with sessile glands, has no adhering sand particles suggesting that the glands do not secrete a glutinous substance.

112. ? **Fagonia myriacantha** *Boiss.* Diagn. 1 Sér. 8 : 123 (1849) ; Fl. Or. 1 : 906 (1867).

Type. Sinai ; *Aucher-Eloy* 798. (G, K !).

Kuweit. Ras Qaliya ; 18 m. ; sandstone cliffs above the sea, growing in sand in underhanging crevices, common ; a thorny plant resembling *al jemba* [*F. bruguieri* DC.], many fruits visible but no flowers ; 2 Dec. 1934, *Dickson* 147. Arafjan ; sea level–60 m. ; flowers purple ; June 1935, *Dickson* 223 B.

Distribution. Sinai, Arabia, Persia, Baluchistan.

These specimens are named *F. myriacantha* with some doubt. Originally placed in *F. bruguieri* DC. they have been noted as distinct in the more robust and erect bushy habit and the more evenly ribbed, less deeply sulcate, stem. The leaves are simple and nearly sessile while the spines vary from 4–16 mm. in length, but are usually less than 10 mm. long. The fruits most often remain erect, the pedicels varying from 3–8 mm. and the style being about half the length of the fruit. In *F. bruguieri* the leaves are often trifoliolate and distinctly petiolate and the spines are fine, about 5–10 mm. long ; the fruits are small (3–4 mm. across), pendant and very shortly pedicellate.

The type specimen of *F. myriacantha*, which in the Kew herbarium is only the basal fragment of a plant, has the less ridged type of stem, but the spines most often reach to 15 or 16 mm. and the whole plant is distinctly glandular. Mrs. Dickson's material can be linked with it through a series of other specimens. *Schimper* 251 from Sinai which is slightly glandular and has stout stems and long spines often over 20 mm. long is very similar to *Fernandez* 14 from the Bahrein Islands, while *Good* 70, also from the Bahrein Islands approaches the Kuweit specimens in being less robust and having spines most often about 12 mm. long ; the fruits usually become pendulous and have the style about half the carpel length.

Dickson 223 B shows some tendency towards *F. parviflora* Boiss. in its habit, the long pedicels and simple oblong linear leaves, but the latter, which is a tropical Arabian plant, has the stem even more rounded and has fine spines from 10–25 mm. long.

113. Fagonia sp.

Arabia. Dhahran ; 75 m. ; *draighma* ; common everywhere on Jabal and below in sandy plain ; thorny spreading bush with white or very pale mauve flowers ; 31 Mar. 1942, *Dickson* 471 B and 471 " B ".

There are two specimens under this number, both of which are sterile, but which are almost certainly distinct. *Dickson* 471 B is a glutinous plant with striate stems, simple oblong-ovate and petiolate leaves, and stipular spines usually from 10–16 mm. long. It is close to *F. parviflora* Boiss., which has however, narrower smaller leaves and is glabrous or glandular but never glutinous. *Dickson* 471 B appears to be the same as an unidentified sterile plant from the Bahrein Islands collected by *Good* (69).

The remainder of the material, *Dickson* 471 " B ", consists of a fine occasionally branched and almost glaucous plant with faintly striate stems and internodes up to 40 mm. long. The leaves are simple, shortly petiolate and narrower than in the other specimen, while the stipular spines are fine and vary from 4–8 mm. in length. This plant approaches *F. subinermis* Boiss. and *F. glabra* Krause.

114. Nitraria retusa (*Forsk.*) *Aschers.* in Verhandl. Bot. Ver. Prov. Brand. 18 : 94 (1876).

Peganum retusum Forsk. Fl. Aeg.-Arab. 211 (1775).

Nitraria senegalensis Lam. Ill. des Genr. 2 : t. 403, f. 2 (1797 ?) ; Poiret in Lam. Encycl. Méthod. 4 : 493 (1797 ?).

N. tridentata Desf. Fl. Atl. 1 : 372 (1798).

N. sericea Jaub. & Spach, Ill. Pl. Or. 3 : t. 294 (1850).

Type. Egypt, Alexandria ; *Forskal* (C—not seen).

Kuweit. Arafjan ; sea level ; *ghardug* ; salty ground near sea ; a thorny bush about 3 ft. high generally growing on a mound of earth, tufts of white flowers grow out from the stem ; a favourite bush for shrikes on which to impale their food of lizards, etc. ; 15 Mar. 1935, *Dickson* 218.

Distribution. Senegal, Morocco, Algeria, Libya, Egypt, Sinai, Palestine, Transjordan, E. Iraq.

This is the most easterly record of the species in the Kew herbarium and also the first record from Arabia. It links up with a single specimen from East Iraq, that of *Guest* 1731 collected at Mandali.

N. retusa is a somewhat variable species with regard to pubescence, and the shape of the leaf, calyx and ovary, some of the variants being named by the synonyms listed above. As, however, there are intermediate grades between these forms it seems most desirable to follow Boissier and to retain all the material as one species. The plant from Senegal, not very well represented in the Kew herbarium and much more tropical than the remainder of the material, is the most distinctive ; it has almost

glabrous, entire or slightly emarginate leaves and darkly pigmented calyx-lobes.

Specimens from further east have densely appressed pubescent leaves and inflorescences, but the leaf shape varies considerably and may be entire or emarginate, lobed at the apex or even tridentate ; this character however often changes on a single plant, the most recently formed leaves being dentate and the lower more mature ones being entire. In *Dickson* 218 almost all the leaves have entire margins.

115. Seetzenia orientalis *Decne.* in Ann. Sci. Nat. 2 Sér. 3 : 281, t. 7 (1835).

Type. Sinai ; June 1832, *Bové* 168 (P, K !).

Kuweit. Wells 7 miles from Kuweit ; sea level ; growing on the edge of cut corn crops ; a dwarf spreading plant with three small triangular leaves with a minute thorn at the end of each, fruits oval divided into five partitions, flowers over ; 30 July 1935, *Dickson* 203.

Distribution. Egypt, Sinai, Afghanistan, Baluchistan, India.

This species is distinct from *S. prostrata* (Thunb.) Eckl. et Zeyh.* and not synonymous as shown by Blatter (Fl. Arab. 94). The flowers are considerably smaller (in *S. orientalis* the calyx is 3–4 mm. long and in the South African *S. prostrata* it is 7–9 mm. long) while the indumentum of the stipules is much less dense in *S. orientalis*. In the latter the styles are short (0·25–0·5 mm. long) and thick, while in *S. prostrata* they are long (6·5–9 mm. long) and slender.

There is one other specimen from Arabia in the Kew herbarium, namely *Maxwell Darling* 189 collected at Aden. It has a laxer habit, longer peduncles and is much less papillose than the Kuweit plant ; it agrees with some, although not all, of the material from Baluchistan, but until further data is available it is not possible to say whether this plant is taxonomically distinct.

In the same year that Thunberg described his *Zygophyllum prostratum*, Willdenow published *Z. lanatum* for which he gave the country of origin as Sierra Leone. This is likely, however, to be an error as no *Seetzenia* has since been found there. Willdenow's description mentions " *styli quinque longi filiformes* ", and therefore agrees better with the S. African *S. prostrata* than the northern *S. orientalis*. As it is not known whether Willdenow's or Thunberg's name has priority, *S. prostrata* (Thunb.) Eckl. & Zeyh. which is in current use, is retained.

Although Robert Brown's species *Seetzenia africana* was published in the Appendix to Denham, Clapperton & Oudney, Narrative of Travels and Discoveries in Northern and Central Africa, it is clearly stated that it was based on specimens collected by Masson in South Africa near Olifant's River. Brown realised that this was Willdenow's *Zygophyllum lanatum* and his specific epithet *africana* is therefore illegitimate in modern nomenclature.

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* *Seetzenia prostrata* (Thunb.) Eckl. et Zeyh. Enum. 98 (1834).
Zygophyllum prostratum Thunb. Prod. Pl. Cap. 189 (1800) ; Fl. Cap. 543 (1823).
Z. lanatum Willd. Sp. Pl. 2 : 564 (1800).
Seetzenia africana R. Br. in Denh., Clapp. & Oudn., Narr. Trav. Discov. North. & Centr. Afr., Append. 231 (1826)—*nomen illegitimum.*

We have not seen the specimens from Adrar in Mauritania quoted by Chevalier as *S. orientalis* (Expl. Bot. L'Afr. Occid. Fr. 97—cf. Hutchinson & Dalziel Fl. W. Trop. Afr. 1 : 137) but they are presumably referable to the northern species.

116. Tribulus terrestris *L.* Sp. Pl. 387 (1753).

Type. Specimen in Herb. Clifford labelled *Tribulus terrestris circeris folio, fructu aculeato* (BM !).

Kuweit. Agency compound Kuweit ; sea level ; gravelly earth extracted from gypsum ; a creeping vetch-like plant with circular small yellow flowers, leaves vetch-like and hairy, seeds with two sharp thorns and two smaller ones, growing two or three in a cluster (only two specimens seen) ; 1 May 1935, *Dickson* 198.

Distribution. S. Europe across Asia to China ; Africa, Arabia, India, Australia ; North and South America, probably as an introduction.

This species under its present limitations in the Kew herbarium is a very variable plant. It is represented by specimens of dwarf annual forms of two or three inches to straggling perennials of a foot or more, and also (in Arabia) by dwarf cushion-like perennials. As with so many of these semi-desert forms the question arises as to the effect of habitat on the growth-form of the plant, and the comparison of annuals with the first year's growth of perennials.

All these plants have fruits with spines, two dorsal and two basal, but the strength and comparative lengths of these spines and the indumentum of the surface of the fruit varies considerably. In much of the material the fruits are 5–7 mm. long, with dorsal spines of about the same length and basal spines half the length. In other specimens the fruit is smaller with the dorsal spines comparatively finer, but at the same time about 1½ times as long.

The specimen in the Linnean herbarium is in the young fruiting stage, the fruit size and spine development being similar to those of *Dickson* 198, although in the latter the indumentum of the fruit is softer and finer.

Mrs. Dickson's plant, which is a perennial with spreading branches of 6–8 ins. in length, has spinulose-subcristate fruits up to 7 mm. long with dorsal spines of about 5 mm. and basal ones of 2 mm. The stigma, which usually in this species is 1–1·5 mm. long, pyramidal and almost sessile, as in the type specimen, is in the Kuweit plant only 0·5 mm. long, about equal to the length of the style and more capitate than pyramidal. This feature is carried still further in material from Arabia and Sinai. In a Sinai specimen collected by Lord in May 1868, the small capitate stigma of less than 0·5 mm. is only about half the length of the narrow style ; the fruit is similar to that of *Dickson* 198 although a little smaller. From Arabia there is a dwarf woody cushion-like plant collected by Bent at Muscat, which has minute fruits 3·5 mm. long, with dorsal spines rather low down and 1 mm. long, and no basal spines, while the stigma is short and capitate on a narrow style ; there are plants from the area of Jedda with similar small fruits and capitate stigma, but which appear to be annual, while other annual specimens from the Oman district of Arabia have a narrow style with the stigma of about equal length (0·75-

mm.) and width (0·25 mm.), the stigmatic rays being almost parallel with the style.

Kralik (in Ann. Sci. Nat. 3. Sér. 11 : 26. 1849) recognised three new species in his section *Armati*, all from areas of Arabia, Egypt and the Nubian desert, and it is possible that some of the plants quoted above may come under these species. Until Kralik's type specimens can be examined together with his descriptions, and until further material can be collected to show population and habitat variations, it seems advisable to place them within a rather broad concept of *T. terrestris* L.

117. Zygophyllum coccineum *L.* Sp. Pl. 386 (1753).

Z. desertorum Forsk. Fl. Aeg.-Arab. 87, t. 11 (1775).

Z. propinquum Decne. in Ann. Sci. Nat. 2 Sér. 3 : 283 (1835).

Type. Not precisely designated.

Kuweit. Kuweit, near sea shore and all salty tracts ; sea level ; *hurrm* ; salty damp ground, very common ; a juicy, fleshy-leaved bush about 1¼ ft. high, the larger yellow heads seem to contain the flower, although I have seen a small white flower later on ; not eaten by sheep, camels or goats, and no use for anything ; 29 Dec. 1934, *Dickson* 151. Shuwaikh–Kuweit ; flowers over, creamy green in colour ; 15 Dec. 1950, *Dickson* (without number).

Distribution. Nubia, Egypt, Sinai, Arabia, S. Persia, Baluchistan, Sind.

Neither the type specimen of *Zygophyllum coccineum* nor that of *Z. desertorum* has been seen and the material under these names at Kew shows considerable variation, so that the synonymy and determinations should be treated with reserve. It is to be hoped that further plants, both in flower and fruit, collected from all areas of distribution may be examined and compared with the type specimens. In the meantime, however, there are certain characters which are worth noting from examination of the available material.

The Egyptian specimens have long pedicels about equal to or slightly longer than the flowers which are 5 or 6 mm. long, the fruits have parallel sides, are slightly winged when mature and vary from 7·5–9 mm. long by 3–4·5 mm. broad ; some specimens from Sinai also belong here including a fragment collected by Bové (*Decaisne* 275 in herb. Gay) which is the type of *Z. propinquum* Decne. Plants from the area of Jedda in Arabia and from the Nubian coast across the Red Sea are probably in close affinity too, although some of them have leaves up to 6 mm. across compared with only 2 mm. of those from Egypt.

Also from Sinai are specimens collected by Bové, which have fruits broader at the top than at the base with distinct wings on the outer angles, and 8·5–10 mm. long by 4–5 mm. across. *Wakefield expedition* 34 from Hadramaut and *Dickson* 151 have similar fruits although not so distinctly winged, but *Dickson* s.n. has shorter fruits 6–7 mm. long by 4–5 mm. across and scarcely winged, which also taper somewhat towards the base. Specimens from the area of the Bahrein Islands collected by Good, Guest and Fernandez have similar fruits of 4–8 mm. long by 3 mm. across but the leaves are small, the ovate blade being only 2 or 3 mm. long

and the petiole scarcely more, compared with the linear segments of 10–15 mm. from other areas.

Linnaeus with his original brief description of " *Zygophyllum capsulis cylindricis* " referred to a synonym " *Fabago arabica, teretifolia, flore coccineo* " in Shawius Catalogus Plantarum, Africae & Asia (No. 231, t. 231. 1738), and he gave Aethiopia for the distribution. There is no specimen in the Linnean herbarium and the flowering material illustrated by Shaw has not been seen, neither has the specimen which Shaw cited from Sherard's collection at Oxford. Forskal meanwhile cited Cairo to Suez as the area for *Z. desertorum*, and his illustration is very similar to the Egyptian material, although the fruits appear to be longer in proportion. There is recorded from Egypt and Sinai a hybrid *Z.* × *guyotii** and although this does not seem to describe any of the above specimens, it suggests that the occurrence of this form of variation might be worth further examination.

118. Zyphoyllum simplex *L.* Mant. [prima] 68 (1767).

Z. portulacoides Forsk. Fl. Aeg.-Arab. 88, t. 12, f. B (1775).

Type. Arabia ; *Forskal* ; cult. in Horto Upsaliensi (not seen).

Arabia. Dubai ; limestone rocky ground, sparsely covered with sand ; growing horizontally and spreading over the ground, with small yellow flowers and succulent leaves ; 10 Mar. 1937 ; *Holmes* (*Dickson* 344 H). Dubai–Oman Coast, Persian Gulf ; 3 m. ; limestone rocky ground, sparsely covered with sand ; small yellow flowers, succulent leaves and bushy growth ; 10 Mar. 1937, *Holmes* (*Dickson* 346 H).

Distribution. Cape Verde Islands ; Central Sahara ; Egypt, Sinai, Palestine, Arabia, Baluchistan, N.W. & W. India ; Sudan, Abyssinia, Somaliland, Socotra ; Angola ; Comoro Islands ; S. Africa.

Christensen (in Dansk Bot. Arkiv. 4, Nr. 3 : 19. 1922) noted that " Linnaeus described his species from plants raised from seeds sent from Cairo by Forskal ". Whether Christensen had any reason for inserting Cairo instead of Arabia is not known. There is no material of this plant in the Linnean herbarium.

The species always has simple, sessile, terete and fleshy leaves, but they vary from 3 mm. to 20 mm. in length. Although usually linear obtuse, they are in the smaller sizes, as represented by *Dickson* 346 H, often almost obovate obtuse ; in this material the leaves are 3–6 mm. long by 1·5–2·5 mm. broad.

Geraniaceae

119. Erodium byroniifolium *Boiss.* Diagn. 1 Sér. 1 : 61 (1842) ; Knuth in Pflanzenreich, Geraniac. 226 (1912).

Type. Sinai ; *Aucher-Eloy* 2087 (G, K !).

Kuweit. Batin–Mahazul, 100 miles west of Kuweit ; 120 m. ; puffy ground on slopes of Batin ; cranesbill with large blue flowers and with stem and underside of leaves pink ; 17 Mar. 1946, *Dickson* 515.

* *Zygophyllum* × *guyotii* Kneuck. et Muschl. in Allg. Bot. Zeitschr. 13 : 36 & 40 (1907). *Z. album* L. × *Z. coccineum* L.—Kneuck. in Allg. Bot. Zeitschr. 10 : 162 (1905).

Distribution. Egypt, Sinai, " Arabia petraea ", Iraq, Persia, Afghanistan, Baluchistan.

Aucher 2087, of which there is a duplicate in the Kew herbarium, is chosen as the provisional lectotype. Boissier also quoted *Aucher* 4299 collected at Ispahan, Persia, and this material although it agrees in general character with that from Sinai, has the indumentum more appressed. *Aucher* 2087 is closely covered with short stiff spreading hairs especially noticeable on the calyx. The Kuweit specimen, which is a small plant in its early flowering stage, shows a similar form of pubescence to the Persian plant, as also do many of the specimens from the eastern range of distribution in the Kew herbarium. For distinctions between *E. bryoniifolium* and *E. glaucophyllum* see under the latter.

120. Erodium ciconium (*L.*) *Ait.* Hort. Kew. ed. 1, 2 : 415 (1789) ; Knuth in Pflanzenreich, Geraniac. 260 (1912).

Geranium ciconium L. Cent. 1 : 21 (1755), et in Amoen. Acad. 4 : 282 (1759), et Sp. Pl. ed. 2 : 952 (1763).

Type. S. Europe (Linn !).

Kuweit. Arafjan ; Mar. 1933, *Dickson* 2. Arafjan, Kasr-al-Abid ; sea level ; 28 Feb. 1935, *Dickson* 2 A. Zor Hills ; *Cox* 19.

Distribution. S. Spain, S. France, Sardinia, Italy and Sicily, Hungary, Balkan Peninsula ; Morocco to Egypt ; Cyprus, Asia Minor, Syria and Palestine to Afghanistan.

The specimens from Arafjan form the first collection from Arabia in the Kew herbarium. *Cox* 19, originally determined as *E. cicutarium* (L.) Ait., has the typical leaf form of *E. ciconium* ; the rachis between the pinnae is distinctly dentate, while the poorly preserved flowers have large sepals up to 10 mm. in length.

121. Erodium deserti (*Eig*) *Eig* in Pal. Journ. Bot. J. Ser. 1 (3) : 311 (1939) ; Zohary in Pal. Journ. Bot. J. Ser. 1 (3) : 248 (1939).

E. moschatum (L.) Ait. ssp. *deserti* Eig in Beih. Bot. Centr. 50, 2 : 236 (1932).

Type. Palestine, not precisely designated (Jerusalem).

Kuweit. Arafjan ; 1935, *Dickson* 87A. Batin-Mahazul, 100 miles west of Kuweit town ; 120 m. ; puffy ground on slopes of Batin ; small cranesbill with large purple flowers growing on single stem from small fine leaves at base ; 17 Mar. 1946, *Dickson* 516.

Arabia. Jabal Amuda–Mish'ab ; 15–60 m. ; slopes of hill ; compact plant of cranesbill with green leaves and stems at base of plant and with purple-green flower stems and purple flowers ; 7 Apr. 1949, *Dickson* 601. Wadi Badanah, 40 miles west of Wadi Arar ; 18 Apr. 1950, *Dickson* 670 B [part]. Wadi Arar ; 450 m. ; wadi bed ; small cranesbill with leaves at base and upright stalks of mauve flowers and fruits ; 18 Apr. 1950, *Dickson* 674. North Midian ; *Burton.*

Egypt. Galāla ; 1100 m. ; 6 Apr. 1877, *Schweinfurth* 199. Wadi Hamata ; 13 Apr. 1880, *Schweinfurth* 114. Salum ; Mar. 1933, *Palmer* 74. Gebel Yammum el Asmar (nr. Bir Gindali) ; on flint hills ; 8 Apr.

1945, *Davis* 10375, 10393. One Km. south of Km. 25 on Cairo–Suez road ; annual ; flowers reddish purple, leaves green ; 12 Feb. 1945, *Davis* 8178. Gebel Yammum el Asmar ; on gravel slopes ; annual, viscid, flowers purple ; 5 Mar. 1945, *Davis* 8269. Km. 24 on Cairo–Suez road ; hills of flint and gravel ; 7 Apr. 1945, *Davis* 10267 ; same locality ; 14 Apr. 1945, *Davis* 10304. Sinai ; Serbal ; *James*.

Palestine. Jericho ; 1863–4, *Lowne*. Ara'ir ; Feb. 1872, *Hayne*.

Transjordan. Wadi Themed ; 27 Apr. 1945, *Davis* 9641.

Iraq. 13 miles N.E. of Baquba ; 18 Mar. 1929, *Cowan* and *Darlington* 177. Near Felluja ; on *haswah* land ; 6 Mar. 1930, *Guest* 960.

Persia. In arenosis insulae Korgo, sinus Persici ; 7 Jan. 1842, *Kotschy* 15. Ruschar ; 13 May 1885, *Stapf* 65.

The first valid publication of *E. deserti* seems to have been made in November 1939. Eig's previous reference, when he described the subspecies *deserti* and said " further study may prove that ssp. *deserti* of *E. moschatum* is an independent species (*E. deserti*)" being considered invalid. Both Zohary and Eig in separate papers of the same volume published in November 1939 gave the new combination *E. deserti*. It is reasonable to assume, however, that Eig himself decided to give the plant specific rank and as he actually mentioned ssp. *deserti* as well as giving its reference we accept the second citation for this species. Eig with his description of the subspecies listed several collections from Palestine, without any indication of a type specimen and none of these numbers has been examined at Kew.

This species is superficially very like *E. cicutarium*, but the fruit shows the glandular pit and well-marked glandular furrow characteristic of *E. moschatum*. It certainly deserves specific rank and it is remarkable that it should apparently have been misplaced by botanists for so long. In view of the little that is known of the plant it has seemed desirable to set out its full distribution. Other distinguishing features of the species are the sepals ending in a purple mucro, which lacks the terminal bristle characteristic of *E. cicutarium*, and the filaments with teeth at the base.

The Arabian plants vary from 2–7 ins. in height and the bipinnatisect leaves have narrow, finely divided segments. The sepals are reticulately nerved, but in *Dickson* 601, which has considerable purple colour in the sepals, the pigmentation masks the venation. In most specimens there is over the whole plant, including the calyx, a short spreading indumentum, but in *Dickson* 87A the sepals are almost glabrous and the remainder of the plant is only sparsely pubescent. *Dickson* 670B [part] and 674 are very similar in character to two plants from Egypt, *Schweinfurth* 114 and 199, which Knuth quoted as typical *E. cicutarium*.

Several specimens of very close affinity to *E. deserti* have been examined from Morocco ; they seem to represent *E. cicutarium* ssp. *bicolor* Murb. described from the area of Ben Guerir and Marrakech and transferred to a variety of *E. praecox* (Cav.) Willd. by Maire.* As far as can be seen from herbarium material the fundamental features of leaves, bracts and indumentum, of calyx, stamens, staminodes and fruits all agree with *E.*

* *E. praecox* (Cav.) Willd. var. *bicolor* (Murb.) Maire in Jahand. et Maire, Cat. Pl. Maroc. 443 (1932).
E. cicutarium (L.) Ait. ssp. *bicolor* Murb. Contr. Fl. Maroc. 2 : 3, t. 1 (1923).

deserti. The petals, however, are up to 10 mm. in length, and lilac in colour with a distinct black spot at the base of the inner two ; in *E. deserti* which extends eastward from the Nile the petals are up to 6 mm. in length and are uniformly purple in colour.

The type material of *Geranium praecox* Cav. has not been seen, but the description and figure (Diss. 5 : 272, t. 126, f. 2. 1788) suggest a form of *E. cicutarium* as shown by Knuth (in Pflanzenreich, Geraniac. 277. 1912). Under *E. praecox* Maire included as a synonym *E. ambiguum* Pomel (Nouv. Mat. Fl. Atlant. 338. 1874) from Garrouban in N.W. Algeria and the description of this is almost the same as for Murbeck's *E. cicutarium* ssp. *bicolor*. The differences which Murbeck noted were the acute bracts and glabrous filaments of *E. ambiguum* compared with the obtuse bracts and hairs at the base of the filaments of his ssp. *bicolor* and he also pointed out some variation in the colour of the petals with the black spot present in both cases. The type specimens of these plants have not been examined, but from the descriptions and material available it appears that *E. ambiguum* and *E. cicutarium* ssp. *bicolor* are closely related and are perhaps synonymous.

Referring back to *E. deserti*, which agrees with *E. cicutarium* ssp. *bicolor* in all features except the petals, it can be seen that further investigation may well prove that the Near East plant should be taken up as a subspecies of the earlier *E. ambiguum*. The present distinction in the herbarium of the geographical ranges of these plants suggests no closer affinity than a subspecific one.

122. Erodium glaucophyllum (*L.*) *Ait.* Hort. Kew. ed. 1, 2 : 416 (1789) ; Knuth in Pflanzenreich, Geraniac. 231 (1912).

Geranium glaucophyllum L. Sp. Pl. 679 (1753) ; ed. 2, 952 (1763).

G. crassifolium Forsk. Fl. Aeg.-Arab. 123 (1775).

Type. Egypt ; *Royen* (Leiden—see note below).

KUWEIT. Dhar–Kuweit ; 120 m. ; *al dubgha* ; stony ridges ; a variety of cranesbill with deep pinky-mauve flowers and large leaves ; eaten by all animals ; 15 Apr. 1935, *Dickson* 195. Batin-Mahazul, 100 miles west of Kuweit ; 120 m. ; puffy ground on slopes of Batin ; cranesbill with large purple flowers and with leaves and buds edged with red ; 17 Mar. 1946, *Dickson* 514.

ARABIA. 140 miles south of Kuweit town ; 90 m. ; low stony hill in *hamdh* country (Sūda area) ; nearly prostrate cranesbill with dark purply-blue flowers ; 3 May 1947, *Dickson* 553.

Distribution. From Morocco, across N. Africa to Egypt and Sinai, Palestine, Syria, Arabia, Iraq, Persia.

Linnaeus's entry under *Geranium glaucophyllum* is copied verbatim from Royen (Fl. Leyd. Prodr. 354. 1740) and the type is presumably in van Royen's herbarium at Leiden.

The combination *Erodium glaucophyllum*, as with many of the species of *Erodium*, is often attributed to L'Héritier, but the name was first published by Aiton. His reference, and also that of Knuth (l.c.), to L'Héritier n. 25, is to an unpublished text on the *Geraniaceae*. Certain figures illus-

trating this text were published as Geraniologia Historia, Iconibus Illustrata (1787–88).

Knuth in his key separates this species and *E. bryoniifolium* Boiss. on "*valvulae non verrucosae*" and "*valvulae nigrescenti-verrucosae*", but from the material examined at Kew the carpels do not appear to vary in this way. Some of the specimens of *E. glaucophyllum* from Algeria and Tunis do not show the pigmentation ; the carpels are pale in colour, and over the surface have short, soft hairs and longer, stiff bristles which are enlarged at the base. Other material of this species and of *E. bryoniifolium* has carpels from light brown to dark brown and the enlarged scaly bases of the bristle-like hairs are darkly pigmented. The strength of the colour in the carpel itself and the density of the finer hairs sometimes masks this pigmentation.

The chief distinguishing characters of the two species seem to be the three-nerved outer sepals and the lanceolate acuminate free bracts of *E. bryoniifolium* in contrast to the five-nerved outer sepals and deltoid or deltoid-ovate acute bracts, often joined at the base, of *E. glaucophyllum* ; also the former has a single ridge at the apex of the carpel while the latter has two concentric ridges.

In *E. glaucophyllum* as in *E. bryoniifolium*, there is considerable variation in the indumentum. Many of the specimens seen are almost entirely glabrous while others have a fine pubescence on stems, leaves and sepals. There is a graduation of strength of indumentum from *Dickson* 195 which is glabrous except for sparse pubescence at the base of the calyx and a line of hairs along the upper surface of the petiole, to *Dickson* 553 which has fairly evenly distributed, short, fine spreading hairs on the calyx, stems and petioles, and appressed hairs on the leaves. In other specimens the stems are glabrous, but the remainder of the plant is pubescent (e.g. *Sandwith* 2675 from Tripolitania, *Field* & *Lazar* 125 from Rutba, Iraq), while a plant collected between El Golea and the Grand Erg, Algeria (*Chipp* 143) has a similar indumentum to *Dickson* 553, but it is more evenly and densely distributed.

Two varieties have been described for this species : var. *cinerascens* Chev. (in Bull. Herb. Boiss. 2 Ser. 5 : 440. 1905) from Algeria and var. *hirsutissimum* Zohary (in Proc. Linn. Soc. London, 153 : 103. 1941) from Zubair. Zohary makes no reference to flower colour while Chevalier for his variety described the flowers as "*pallide roseis, saepe albis vel striatis.*" *Sandwith* 2675 and *Chipp* 143 noted that the flowers were deep purple-pink and mauve respectively and in all the Arabian specimens quoted above they are of a deep colour. Any correlation between flower colour and strength of indumentum cannot be made from the insufficient data which we have available at present. None of the specimens from Arabia and Iraq seem to qualify for the epithet *hirsutissimum*, and until further evidence is obtained on variations in the colour of flowers the material at Kew cannot be differentiated into varieties.

123. Erodium laciniatum (*Cav.*) *Willd.* Sp. Pl. 3 : 633 (1801) ; Knuth in Pflanzenreich, Geraniac. 241 (1912).

Geranium laciniatum Cav. Diss. 4 : 228, t. 113, f. 3 (1787).

G. triangulare Forsk. Fl. Aeg.-Arab. 123 (1775) ?—*nomen dubium.*

Erodium triangulare (Forsk.) Muschl. Man. Fl. Egypt, 1 : 558 (1912)—*nomen dubium.*

Type. Mauritania ; *Jussieu* (Madrid, photograph K !).

Distribution of species. Widespread from western Mediterranean countries to Afghanistan.

ssp. **laciniatum.**

E. laciniatum var. *genuinum* Boiss. Fl. Or. 1 : 893 (1867) ; Knuth in Pflanzenreich, Geraniac. 242 (1912).

Kuweit. Arafjan, near Kasr al Abid ; sea level ; in depressions between the sand-dunes along the sea shore ; a giant cranesbill, height about 18 ins., flower pale bluey mauve and fruits about 3 ins. long ; eaten by camels etc. ; 28 Feb. 1935, *Dickson* 2 B. Arafjan ; *rugum* ; Mar. 1933, *Dickson* 97. Farsi Island (Persian Gulf 28° N. 50° E. approx.) ; sea level ; a strong growing cranesbill with pale mauve flowers ; 17 Mar ; 1950, *Lady Hay* (*Dickson* 646).

ssp. **pulverulentum** (*Cav.*) *Burtt et Lewis* **comb. nov.**

Geranium pulverulentum Cav. Diss. 5 : 272, t. 125, f. 1 (1788).

Erodium pulverulentum (Cav.) Willd. Sp. Pl. 3 : 632 (1801) ; Eig in Beih. Bot. Centr. 50, 2 : 230 (1932).

E. pulverulentum var. *hispanicum* DC. Prodr. 1 : 645 (1824).

E. laciniatum var. *pulverulentum* (Cav.) Boiss. Fl. Or. 1 : 893 (1867) ; Knuth in Pflanzenreich, Geraniac. 243 (1912).

Type (of ssp.). Spain, in monticulis arenosis inter Aranjuez et lacum Antigolae ; *Cavanilles* (Madrid—not seen).

Kuweit. Arafjan ; *rugum* ; Mar. 1933, *Dickson* 87. South of Araq wells (95 miles south of Kuweit) ; 12 m. ; *rugum* ; common in this district amongst plantains, sorrells etc. ; a pale mauve-flowered, small cranesbill growing in sandy ground ; 10 Jan. 1935, *Dickson* 154. Agency compound, Kuweit ; sea level ; growing in compound near sea, but common everywhere ; a flat growing, pale purple-flowered cranesbill ; 17 Feb. 1935, *Dickson* 165. Masjan Island, 2 miles N.W. of Failaka Island ; sea level ; flowers pale purple ; 21 Mar. 1938, *Dickson* 435. Zor Hills ; *Cox* 17.

Arabia. Dubai ; sandy covered limestone ridge ; pink flowers, straggling horizontal growth ; sheep and goats' fodder ; 10 Mar. 1937, *Holmes* (*Dickson* 358 H). Wadi Arar ; 450 m. ; *dabgha* ; in wadi ; cranesbill with pale purple flowers ; 18 Apr. 1950, *Dickson* 670. Wadi Badanah, 40 miles west of Wadi Arar ; 18 Apr. 1950, *Dickson* 670 B [part].

var. **bovei** (*Del.*) *Hochr.* in Ann. Conserv. Jard. Genev. 7 et 8 : 175 (1904) ; Knuth in Pflanzenreich, Geraniac. 244 (1912) excl. syn. *E. pulverulentum* var. *tunetanum* DC. Prodr. 1 : 615 (1824).

Erodium bovei Del. Ind. Hort. Monsp. 6 (1838), et in Linnaea. 13, Litt. 104 (1839).

E. laciniatum (Cav.) Willd. ssp. *bovei* (Del.) Murb. Contr. Fl. Nord-Ouest Afr. 1 : 53 (1897).

Type (of var.). Sinai; *Bové*; cult. Monspeliensis (P—not seen).

Kuweit. Batin – Mahazul, 100 miles west of Kuweit town; 120 m.; puffy ground on edge of Batin; flowers pale mauve, smaller than three other species, stems slightly pink; 17 Mar. 1946, *Dickson* 517.

Arabia. On road to Hofuf, south of Abqek oil camp; sandy ground where recent rain had fallen; cranesbill; 23 Mar. 1947, *Dickson* 559.

According to Christensen (in Dansk Bot. Arkiv. 4, No. 3 : 23. 1922) there is in Forskal's herbarium no specimen which agrees with his short description of *G. triangulare* : "*foliis triangularibus, subpinnatifidis, dentatis, vix villosis.*" Forskal inscribed the name *G. maritimum* on a specimen identifiable (*teste* Christensen) as *E. laciniatum* so that it is doubtful if he also described this plant as *G. triangulare*; Christensen does suggest however, that Forskal's *G. maritimum* may be a glabrescent form of his *G. triangulare*. In the absence of the type specimen of *G. triangulare* it is undesirable to follow Muschler in adopting this name, for the description is too brief to be conclusive. Cavanilles gave a much fuller description and an illustration of his *G. laciniatum*, which Willdenow later transferred to *Erodium*, and his name is therefore maintained.

Erodium laciniatum is a very variable species especially in indumentum, form of calyx and involucre. This involucre at the base of each umbel may be formed of from 2–8 bracts, which are broad and obtuse or narrower and overlapping, according to the number present. When there are only two bracts they are often partially divided at the tips and have a distinct separate venation for each segment. Cavanille's illustration of *G. laciniatum* shows five narrow, acute, free bracts, while they are described as "*involucrum scariosum multifidum*". From the photograph of the type specimen, kindly sent from the Jardin Botanico, Madrid, there certainly appear to be about five separate bracts as figured by Cavanilles.

The status of subspecies *pulverulentum* is a difficult problem and a very careful study, both morphologically and ecologically, is required over the whole range of the species. It may be that a study of this kind would show that those authors (such as the late Dr. Eig of Jerusalem) who have reverted to Cavanille's original treatment of *pulverulentum* as a distinct species are justified. At present, however, the application of this view to a large herbarium is not satisfactory : it leaves too many specimens *incertae sedis*.

If classified as a variety of *E. laciniatum* it is clear that the varietal epithet *hispanicum* must be adopted in preference to *pulverulentum*. In view of the possible specific rank of the group, that change would be unfortunate. Within our area it is possible to distinguish three units corresponding to the varieties *genuinum*, *pulverulentum* and *bovei* of Knuth's monograph; but botanically the last two are more closely related (in indumentum and lack of well-marked sepaline mucro) to one another than they are to var. *genuinum*. It therefore seems that the best treatment, pending a thorough revision of the group, is to recognise true *laciniatum* and *pulverulentum* as subspecies and to classify *bovei* as a variety of the latter.

E. laciniatum ssp. *laciniatum* is pubescent with short stiff hairs, often appressed on the leaves but spreading elsewhere. The involucral bracts may be in pairs joined at the base; they are very broad (3–5 mm. across)

and obtuse, and are membranous white, distinctly tinged with brown colour. In this variety especially, the material examined at Kew shows a range from two bracts to the larger number of the type specimen, but other characters are more constant. The sepals vary from 4·5–6·5 mm. in length including the distinct mucronate tip of 1 mm. and the calyx is usually very shortly pubescent, with a tuft of longer spreading hairs near the pedicel. The fruiting beak varies from 40–60 mm. in length.

E. laciniatum ssp. *pulverulentum* has the lower leaves rather simply lobed, but those further up the stem become more deeply divided as in the typical plant. The indumentum is of short crisped hairs often with glandular hairs on the pedicels and the bracts and stipules are not tinged with brown colour. The calyx varies from 4·5–5·5 mm. in length, the sepals being oblong and acute or slightly mucronate, while the fruiting beak may be from 35–40 mm. in length. *Dickson* 670 B [part] is somewhat distinct from the remainder of the specimens quoted under ssp. *pulverulentum*. The leaf segments are much narrower and more acute, while the involucral bracts are narrow, up to six or seven in number and are scarcely joined at the base ; the calyx and fruit are similar however.

The earliest publication of the combination *E. laciniatum* var. *bovei* seems to have been that of Hochreutiner in 1904 ; Murbeck's combination in 1897 was subspecific and Knuth has incorrectly accepted this as a variety. Under *E. laciniatum* var. *bovei* (Del.) Murb. Knuth includes *E. pulverulentum* α *tunetanum* DC., which is an earlier epithet in the varietal rank. However, we are retaining the name var. *bovei* for the Arabian plant since, from De Candolle's description, var. *tunetanum* does not appear to be synonymous.

E. laciniatum var. *bovei* has a short fine pubescence over the whole plant and most dense on the calyx. The leaves are smaller and more simply divided than in plants typical of ssp. *pulverulentum*. The sepals are 3·5–4·5 mm. long and are oblong-ovate acute but not mucronate, while the fruiting beak is from 30–40 mm. long. The bracts are 1–2·5 mm. across, they may be pubescent and are often more than two in number. *Wiest* 537 from Birket el Hadschi and *Schimper* 199 from Ras Hamam are very similar to the Arabian plants.

124. Monsonia nivea (*Decne.*) *Webb*, Fragm. Fl. Aethiop. 59 (1854) ; Knuth in Pflanzenreich, Geraniac. 293 (1912).

Erodium niveum Decne. in Ann. Sci. Nat. 2 Sér. 3 : 285 (1835).

Type. Sinai, Tor ; Jun. 1832, *Bové* 154 (P, K !).

KUWEIT. Kuweit ; Mar. 1933, *Dickson* 63 ; 1935, *Dickson* 64A.

ARABIA. Dubai ; sea level ; sandy loose dunes ; bushy woody plant with white flowers and grey green foliage ; used for medicine in fevers ; 4 Mar. 1937, *Holmes* (*Dickson* 335 H). West of Jubail ; 90 m. ; sandy ground ; cranesbill with mauve flowers ; 7 Apr. 1949, *Dickson* 572. Dahana ; from the sand hills, rather sparingly found ; it flowers in the early morning and the petals wither by noon ; 27 & 28 Feb. 1865, *Pelly*.

Distribution. Algeria, Libya, Egypt, Nubia, Sinai, Arabia.

RUTACEAE

125. Haplophyllum arabicum *Boiss.* Diagn. 1 Sér. 8 : 127 (1849).

H. tuberculatum (Forsk.) Juss. var. *arabicum* (Boiss.) Boiss. Fl. Or. 1 : 940 (1867).

Type. Arabia, Fatme ; Feb. 1837, *Schimper* 913 (G, K !).

KUWEIT. Arafjan and generally ; *al mesaisha* ; cure for scorpion stings ; Mar. 1933, *Dickson* 74. Grain Island ; 1935, *Dickson* 74 B. Batin valley ; *al mesaisha* ; growing among *hamdh* with *Dickson* 636–639 [*Caylusea canescens, Zilla spinosa, Anabasis spp.*] ; 26 Nov. 1949, *Dickson* (without number).

Distribution. Arabia, Iraq, Persia.

Both Handel-Mazzetti (in Verh. Zool.-bot. Ges. Wien 63 : 50. 1913) and Schwartz (Fl. trop. Arab. 125. 1939) include *H. arabicum* as a synonym of *H. propinquum* Spach, but the evidence available from examination of the material in the Kew herbarium suggests that there are two distinct species. The exact nature of the type of *H. propinquum* (quoted by Spach as " Circa Bagdad : *Aucher-Eloy* 816, ex parte, in Herb. Webb, et absque numero in Herb. Mus. Par.") is not known, but we have seen a fruiting specimen of *Aucher* 816 (bis) labelled " Egypt, Mesopotamia to Babylon " which agrees reasonably well with Spach's description. The only specimen at Kew with the number *Aucher* 816 is *H. obovatum* Hand.-Mazz. from Egypt.

H. propinquum is confined to Iraq ; in contrast to *H. arabicum* with its pubescent fruits and obovate to oblanceolate shortly pubescent leaves, it has glabrous capsules and, on the flowering branches, glabrous, linear to oblanceolate leaves. The vegetative branches have small obovate acute leaves, densely covered with fine spreading indumentum, and all the leaves have a distinctly greyish appearance.

Of the Kuweit specimens, *Dickson* 74 B is a single young plant with very early flower buds at the apex ; the leaves are oblanceolate and have a short spreading indumentum. *Dickson* 74 has ciliate sepals and a glabrous style, while the plant from Batin valley is more strongly pubescent, having a spreading indumentum on the sepals and to some extent on the outer surface of the petals and base of style. This latter plant agrees well with *Noë* 317 from Mohammera and suggests *H. trichostylum* Boiss., which Handel-Mazzetti includes as a synonym of *H. propinquum.* The type of *H. trichostylum*, collected near Gas between Ispahan and Teheran, is very similar to *H. arabicum* in general aspect ; the style is pubescent however, but unlike the plants collected by Mrs. Dickson and Noë there is no indication of pubescence on the petals. At present it seems reasonable to regard the pubescence of style and petals as inconstant characters and to treat *H. trichostylum* as a synonym of *H. arabicum.*

126. Haplophyllum tuberculatum (*Forsk.*) *Juss.* in Mém. Mus. Hist. Nat. Paris 12 : 528, t. 17 (1825).

Ruta tuberculata Forsk. Fl. Aeg.-Arab. 86 (1775).

Type. Egypt, Cairo ; *Forskal* (C—not seen).

ARABIA. Dhahran ; stony slopes near settlement ; green bushy plant with aromatic leaves and yellow flowers ; 20 Mar. 1947, *Dickson*

522. West of Abu Hadriyeh on Tapline road ; 90 m. ; *al messaicha* ; in sandy ground among *hamdh* ; aromatic herb with yellow flowers ; used as an antidote for scorpion stings ; 7 Apr. 1949, *Dickson* 580. West of Abu Hadriyeh on Tapline road ; 90 m. ; sandy ground ; small plant with reddy green leaves ; 7 Apr. 1949, *Dickson* 607. Dahna sand hills ; rare ; 26 Feb. 1865, *Pelly*.

Distribution. Egypt, Sinai, Palestine, Arabia.

All the specimens quoted above are of a fragmentary nature and leave some doubt as to their character. Mrs. Dickson's three plants are in a very early flowering condition, the inflorescences just being visible ; *Dickson* 580 and 607 both consist of a single flowering shoot with oblanceolate to linear-lanceolate tuberculate leaves, covered with a short softly curled pubescence, and with the flower buds densely pubescent on the outer surface. *Dickson* 522 has both flowering shoots with oblanceolate leaves and also vegetative shoots with obovate leaves. Often in *Haplophyllum* there is such a great variation between the leaves of the flowering and vegetative shoots, both with regard to shape and pubescence, that confusion arises in determining fragmentary material. The specimen collected by *Pelly* appears to be a poorly grown plant of *H. tuberculatum* ; the stems are straggling and woody while the leaves are much reduced and more distinctly pubescent than in other specimens. It is the same as a plant from Wadi Gharaudel and Ramleh, S. Palestine, collected by Lord, and approaches *H. obovatum* Hand.-Mazz., which has a similar type of growth with reduced leaves ; in the latter species however the leaves are all obovate, and not both obovate and oblanceolate as in Pelly's specimen and *H. tuberculatum*.

127. Haplophyllum sp.

Kuweit. Arafjan ; 1935, *Dickson* 74A. Baniyat Arafjan, Kuweit Neutral Zone, on coast ; sea level ; *al messaicha* ; growing in vicinity of hills ; yellow flowered aromatic plant used for scorpion stings ; 11 Apr. 1949, *Dickson* 609.

These are two distinct plants and are fairly complete specimens, but due to the fragmentary nature of the material representing the many species described from Iraq and Persia, the Kuweit plants must for the present remain undetermined. Much more material of the genus *Haplophyllum* is needed to help clear up its taxonomic problems ; complete specimens with the contrasting vegetative and flowering shoots and with flowers and fruits present would overcome some of the difficulties which arise from the present collections.

Dickson 74 A has glandular sepals which are ciliate and pubescent, glandular filaments and a glandular glabrous ovary ; the leaves of the fruiting stems have undulate margins as in *H. tuberculatum*, but the lower ones are divided into three linear to linear-oblanceolate segments. *Dickson* 609 has only slightly glandular sepals, finely ciliate but otherwise glabrous, eglandular filaments and a pubescent ovary ; the leaves are simple, linear to linear-oblanceolate and are up to 45 mm. in length.

128. Peganum harmala *L.* Sp. Pl. 444 (1753).

Type. Cult. in Horto Upsaliensi (Linn !).

Kuweit. Kuweit ; sea level ; rubbish heap ; bushy perennial herb about 18 ins. high with white flowers ; very common between Zubair and Basra, rare in Kuweit ; 15 Apr. 1936, *Dickson* 304.

Arabia. Riyadh ; 660 m. ; *khanaize* ; sandy ground on edge of Wadi Hanifa ; bushy plant with fine leaves and woody stem ; seeds called *nigti* and used as medicine ; 25 Oct. 1937, *Dickson* 392.

Distribution. All countries bordering the Mediterranean ; Hungary, Rumania, Bulgaria, S. Russia and Turkestan to Mongolia ; Arabia and Iraq to N.W. India and China.

CHLOROSCYPHA SEAVER IN BRITAIN.

Chloroscypha Seaver 1931 was proposed for four small greenish inoperculate discomycetes apparently parasitic on leaves of conifers in North America. The type species as *C. seaveri* (Rehm) Seaver. Later Seaver united *Chloroscypha* with *Kriegeria* Rabenhorst 1878, the type species of which was *Ombrophila kriegeriana* Rab. but *Kriegeria* was merely a provisional name not accepted as a genus by its author. Two fungi referable to *Chloroscypha* have been received at Kew on conifers grown in Great Britain and in view of their possible parasitic character it is desirable to place their occurrence on record.

Chloroscypha seaveri (Rehm) Seaver in Mycologia **23,** 249 (1931).

Kriegeria seaveri (Rehm) Seaver in Mycologia **35,** 493 (1943).

On *Cupressus lawsoniana* Murr., Poltalloch gardens, Kilmartin, Argyll, D. S. Melville 15.2.1932. This collection agrees closely with the diagnosis of *C. seaveri*, originally described from *Thuya plicata* in Montana but it is, of course, possible that there may prove to be a specialised race attacking *C. lawsoniana.*

Chloroscypha sabinae (*Fuckel*) *Dennis*, comb. nov.

Peziza sabinae Fuckel—Fungi rhenani No. 1867, 1866.

Dermatea juniperina Ellis in Am. Nat. **17,** 192 (1883).

Cenangium helotioides Sacc. apud Mouton in Bul. Soc. Roy. Bot. Belg. **28** (pt. 2), 81 (1889).

Chloroscypha juniperina (Ellis) Seaver in Mycologia **23,** 250 (1931).

Kriegeria juniperina (Ellis) Seaver in Mycologia **35,** 493 (1943).

On dead leaves of *Juniperus communis* L., Hackhurst Downs, Surrey, 14.3.1954.

Peziza sabinae was described from leaves of *J. sabina* L., and the fungus on *J. communis* has been called *Chloroscypha juniperina* (Ellis) Seaver, based on *Dermatea juniperina* Ellis 1883. The Surrey collection, however, seems indistinguishable from the apothecia in Fuckel's material cited above. It was associated with *Acanthophiobolus helminthosporum* (Rehm) Berl., kindly determined by Mr. E. W. Mason, and with empty hysterothecia and thyriothecia, no doubt those of *Lophodermium juniperinum* (Fr.) De Not. and *Clypeolum juniperinum* Grove respectively.

R. W. G. Dennis.

A NEW SPECIES OF MELANDRYUM FROM UGANDA.

W. B. Turrill.

Most taxonomists working with the *Caryophyllaceae* now keep *Melandryum* generically distinct from both *Lychnis* sensu stricto and *Silene*. The diagnostic characters are rather technical and the whole group requires modern monographic revision. *Melandryum*, as the genus is now usually accepted, has about eighty known species, mainly, but not entirely, temperate Eurasian in range. The occurrence of three species in Tropical East Africa is of phytogeographical interest. So far as is known they have very restricted ranges. *M. lomalasinense* Engler is recorded only from the Masai District of northern Tanganyika. A specimen in the East African Herbarium, Nairobi, apparently of an undescribed species from Uganda : Debasien, 2850 m., Oct. 1945, *J. R. Dale* U.454, has long narrow leaves reminiscent of those of *Lychnis flos-cuculi*. Unfortunately the material is poor and does not justify making it the type of a new species. In the herbarium of the British Museum (Natural History) there are two sheets from Uganda : Mt. Elgon, which have not been matched with any specimens or descriptions. One of these consists of good flowering material with some, probably not quite mature and rather flattened, fruits. This is here made the type of a new species which is named, by the specific epithet, after the collector.

The spelling *Melandryum* Reichb. Handbuch 298 (1837) is adopted, and not *Melandrium* Roehling, Dentschl. Fl. ed. 2, **2,** 274 (1812), in conformity with the ruling published in Taxon **3,** 114 (1954) which was accepted by the 8th Internat. Bot. Congress, Paris, 1954. Roehling's name is, as a genus, a *nomen nudum*. Reichenbach also did not (loc. cit.) publish a description but places the abbreviated name " Clus." after " *Melandryum* ". Presumably this refers to Clusius, Rar. Plant. Hist. 293–4 (1601) where there is an account of the genus, with reference back to Pliny, and two text figures.

Melandryum syngei *Turrill* a *M. auriculato* (S. et S.) Rohrb. foliis angustioribus floribus minoribus facile distinguitur.

Herba perennis, ramosa, caulibus usque ad 2·2 dm. longis a basi leviter suffruticosis dense foliatis internodis dense patule pubescentibus saepissime 3–5 mm. sed usque ad 2·5 cm. longis. *Folia* anguste oblanceolata vel lineari-lanceolata, apice acuta et breviter incrassata, a basi gradatim angustata, 1·4–2·5 cm. longa, 2–5 mm. lata, in pagina utraque dense pubescentia, costa in pagina abaxiale subprominente, nervis lateralibus obscuris. *Inflorescentia* secundiflora, 2–6 cm. longa, 2–5-flora, dense pubescens ; bracteae inferiores lanceolatae, 1 1·3 cm. longae, 2–3 mm. latae, superiores anguste lanceolatae, 3–9 mm. longae, 1–2 mm. latae. *Calyx* 1·1–1·3 cm. longus, 4–6 mm. diametro, dense pubescens, dentibus triangulari-lanceolatis acutis breviter apiculatis 4–5 mm. longis 3 mm. latis a basi. *Internodus* inter calycem et corollam 5 mm. longus. *Petala* 1·0 1·2 cm. longa, a pagina abaxiale pubescentia, lamina bifida 5 mm. longa, alba, coronae squamis 1 mm. longis. *Stamina* 5 + 5, filamentis gracilibus 9 mm. longis, antheris ambitu oblongis 2 mm. longis. *Ovarium* breviter cylindricum, 4 mm. longum, 2 mm. diametro, ovulis circiter

40 instructum ; styli 3, 4 mm. longi. *Capsula* brevissime cylindrica, 9 mm. longa, valvis 6 praedita.

Uganda. Bugishu " Province ", Mt. Elgon, N.W. slopes, May 1935, 3750 m., on damp rocks, *P. M. Synge* S.1912. Holotype in Herb. Brit. Mus. (Nat. Hist.).

The collector has the following field notes : " Flowers creamy white. Sepals with deep brown ridges along centre and edge. Rare."

A second sheet, to be placed in the same species, has the following data on the label : Mt. Elgon. Above Mudange. Aug. 1934. On rocky face of cliff. 12500′. Ht. 6″. Flowers white. Leaves pubescent. *P. M. Synge* S.938. This specimen, a single piece, has on the average larger, and especially broader, leaves than those of *Synge* 1912. The well-developed leaves are 3–3·5 cm. long and 3–7 mm. broad.

The nature and definition of plant genera.*—The title of this symposium is misleading ; none of the authors has added anything to our knowledge or appreciation of the nature and definition of plant genera, though all of them have given excellent examples of how disciplines other than gross morphology may aid the elucidation of taxonomic problems at the species level and one of them (M. S. Cave) has shown how cyto-embryology can assist in the delimitation of supra-generic groups. R. C. Rollins (cytogenetics) points out that the researches of Clausen, Keck and Hiesey have shown that certain small genera should be incorporated in larger ones ; this is not, however, a justification for the title of the symposium, for the researches were concerned with individual species which were shown to have been generically segregated on insufficient morphological evidence.

The editor (F. Verdoorn) contributes a foreword which amounts to a plea for the preparation of " generic floras " and he devotes two pages to sample entries from " A Generic Moss Flora " (of Central and North America) now in preparation by W. C. Steere, and no fewer than eleven pages to facsimile reproductions of title and sample pages from old and modern " generic floras ". The latter seem to be a somewhat irrevelant waste of space, since the readers of this symposium will be perfectly familiar with the works cited ; the sample entries from Steere's work do not seem to offer anything new in the way of either treatment or format and indeed may be criticized for the poverty of references to literature, especially in the synonymy.

The introductory essay by T. Just is in effect a further plea for more " generic floras " ; he does not, apparently, appreciate the irony, in this symposium, of Hitchcock's quoted definition of genera,—" Genera are groups of related species ". He regards the genus as the fundamental unit of taxonomy, a view at which most taxonomists will demur.

On the whole, I would recommend this publication to the attention of senior undergraduates. A. A. Bullock.

* Plant Genera. Their Nature and Definition. A Symposium by G. H. M. Lawrence, I. W. Bailey, Arthur J. Eames, Reed C. Rollins, Marion S. Cave and Herbert L. Mason, with an introductory essay on Generic Synopses and Modern Taxonomy by Theodor Just, and a Foreword by Fr. Verdoorn. Chronica Botanica **14** (3), 89–160 (1953). $2.00.

EAST AFRICAN MATERIAL OF CORRIGIOLA.

W. B. Turrill

Corrigiola litoralis is a widely ranging species in central and southern Europe, the Mediterranean Region, and parts of Africa. On examining East African material for the Flora of Tropical East Africa it became evident that the material from Kenya and Tanganyika differed in a number of characters from European specimens. In particular, the East African plants have often stout roots and rootstocks and appear to be perennials, or at least very frequently not clear cut annuals or ephemerals. More definite is the character of flower size. At comparable stages of development the flowers of East African material have about twice the linear dimensions of those of European plants. The leaves of the East African specimens are mostly linear-oblanceolate or linear-elliptic and up to 2 cm. long. They are thus larger than usual in European plants but general outline shapes can be matched in plants from the two areas.

In south-western Europe there occurs *C. telephiifolia* Pourr. in Mém. Acad. Toul. **3,** 316 (1783). The original description of this is not readily accessible to many botanists and is as follows : " 382 Corrigiola (telephiifolia) caule diffuso procumbente, foliis oblongo ovatis, ramis aphyllis seminibus polygonis 2♃.

Dans le Roussilon, aux environs de Boulon, sur les roches qui bordent le grand chemin.

Cette espece differe du *Corrigiola litoralis* L. par son port, par ses feuilles, qui ne sont point linéaires ; par ses semences qui ont plusieurs cotés, et ne sont point triangulaires, et par sa racine, qui est vivace au lieu d'etre annuelle."

In the apparently perennial duration and in the larger flowers the East African specimens agree with *C. telephiifolia.* They differ in the general shape and size, and probably texture, of the leaves and in the occurrence of leaves in the upper, inflorescence-bearing, parts of the branches.

Taking all the available facts into consideration it seems best to accept the East African specimens seen, including those from Abyssinia and Eritrea, as constituting a subspecies of *Corrigiola litoralis* distinguishable from the subsp. *litoralis* especially by the larger flowers and the tendency to form stouter roots and rootstocks. The name subsp. *africana* is proposed and to validate it the following Latin description is published.

Corrigiola litoralis *L.* Sp. Pl. 271 (1753) subsp. **africana** *Turrill,* subsp. nov., a subsp. *litoralis* floribus majoribus praecipue differt.

Herba perennis (vel interdum biennis), a basi ramosissima, glabra. *Rami* graciles, prostrati, 1–4·5 cm. longi, internodis 0·5–1·0 cm. longis. *Folia* lineari-oblanceolata vel lineari-elliptica, apice acuta, basi gradatim angustata, 0·7–2·0 cm. longa, 1·5–3 mm. lata, plus minusve glauca, costa pagina utraque leviter prominente, nervis lateralibus inconspicuis ; stipulae scariosae, inaequaliter ovatae, 3 mm. longae, 2 mm. latae. *Inflorescentiae* compactae, sessiles vel breviter pedunculatae, in ramis foliatis positae ; pedicellae usque ad 1 mm. longae, saepe breviores. *Sepala* ovato-oblonga, obtusa vel subobtusa, 1·25 mm. longa (in fructu usque ad 2 mm.), 0·75 mm. lata, distincte albo-marginata. *Petala*

oblonga, 0·75 mm. longa, alba. *Fructus* a calyce circumclausus, trigono-ellipsoideus, 1·5 mm. altus, 1·2 mm. diametro, fuscus, tenuiter scrobiculatus.

KENYA : in path, Muguga, 13 miles Nairobi–Nawasha, 2190 m., June 1952, *Verdcourt* 663 (Typus in Herb. Kew.) ; Limuru, common weed in tea plantations, 20 June 1941, *S. H. Wimbush* 1504.

TANGANYIKA : Lumi River, E. Kilimanjaro, c. 1200 m., Jan. 1929, *A. E. Haarer* 1741 ; sawmill, Shagai Forest near Sunga, West Usambaras, 1950 m., weed of timber yard, 17 May 1953, *Drummond and Hemsley* 2571.

ABYSSINIA : In agris, sine loco speciali, 1844, *Schimper* 1876, 1853 ; *Schimper* 1002 ; Amogoi, 19 Sept. 1862, *Schimper* 245 ; Adawa, *Petit* ; Mulka jihi, 1620 m., 27 Febr. 1933, sand (granite) by stream, *J. B. Gillett* 5080.

ERITREA : Bei Halai, 2600 m., 28–30 April, 12–16 Mai 1894, *G. Schweinfurth* 208 ; Hamasen, Asmara, 30 Jan. 1902, *A. Pappi* 222.

The notes supplied by collectors are interesting. Verdcourt records as follows : " Rosette plant with very numerous stems to 1 ft. completely prostrate. Foliage glaucous. Flowers minute. Calyx green. Flowers cleistogamous." Drummond and Hemsley note : " Prostrate herb radiating from central root, calyx green edged with red, petals white, filaments white, anthers dark red, ovary, style, and stigma pale green." Wimbush says the plant is " used as a dye plant " and is called " Sergena Root " while Gillett says it is an " eye medicine ". Some of the Abyssinian and Eritrean specimens have less stout roots and rootstocks than plants from Kenya or Tanganyika, but the larger flower size than in subsp. *litoralis* is, for the material seen, constant and characteristic.

" **Amateur Gardening** " **Handbooks.***—Three additions have recently been made to the " Amateur Gardening " Handbook series, namely Nos. 9, 10, and 11. The first of these deals with vegetable gardening. In this book directions are given for the growing of vegetables in English gardens, together with a chart indicating when to sow seed. The second contains information relating to the culture and propagation of house plants, or plants " which remain virtually permanent inhabitants of a room ", and thrive there. The third little book is devoted to lawns and deals with the preparation of new lawns and the care of existing ones.

These books are written in simple language and illustrated by a number of black and white drawings.

H. S. MARSHALL.

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* No. 9. Vegetable Gardening. By A. J. Simons.
No. 10. House Plants. By A. J. Huxley.
No. 11. Lawns. By R. B. Dawson.
(" Amateur Gardening " Handbook Series) London : W. H. & L. Collingridge Ltd. Price 3/6d. each.

AN ARENARIA FROM TROPICAL EAST AFRICA.

W. B. Turrill

The close morphological relationship between *Arenaria serpyllifolia* L. and *A. leptoclados* Guss. is well known to students of the British flora. Plants showing differential characters of calyx and fruit in an extreme degree are usually figured and described while those with "intermediate" or " untypical " characters are often ignored, at least in publications. Outside the British flora even greater difficulties of determination occur and the *Arenaria serpyllifolia* aggregate needs full investigation by the methods of synthetic taxonomy. Meantime names have to be provided for general use and these should be as precisely defined as possible, even if the taxonomic status given is tentative.

Amongst the plants in the excellent collection made by R. B. Drummond and J. H. Hemsley in Tropical East Africa in 1953 are specimens of a small annual *Arenaria* belonging to the *A. serpyllifolia* group. This material has not been matched with any named species. In several of its characters, especially capsule shape, it comes nearest to *A. leptoclados* Guss. but the branches have few flowers and well developed leaves up to the ends of the branches. The leaves are oblanceolate or narrowly elliptic-oblanceolate in outline, narrowed below so as to appear almost petiolate though there is no clearly differentiated petiole. The leaf venation, apart from the midrib, is obscure.

With some hesitation a specific name is given to *Drummond and Hemsley* 2692. Probably to be considered conspecific is the following sheet : British Somaliland : Dobo pass, 1330 m., 5 Feb. 1933, *J. B. Gillett* 4972.

Arenaria foliacea *Turrill*, a *A. leptoclados* Guss. ramis foliaceis, foliis oblanceolatis vel anguste elliptico-oblanceolatis longioribus, praecipue differt.

Herba annua, plus minusve saepe a basi ramosa. *Caules* 4–7 cm. longi, graciles, ad apicem foliati, internodis 4–20 mm. longis dense glanduloso-hispidulis. *Folia* oblanceolata vel anguste elliptico-oblanceolata, apice acuta vel breviter acuminata, basi gradatim angustata sed vix petiolata, 3–11 mm. longa, 1–4 mm. lata, costa in pagina abaxiale leviter prominente, in pagina adaxiale inconspicua, nervis lateralibus fere obsoletis, margine glanduloso-ciliata, in pagina utraque leviter glanduloso-pilosa. *Flores* solitarii ; pedicelli graciles, 2–6 mm. longi, glanduloso-hispiduli. *Sepala* lanceolata, acuminata, inaequalia, 3–4 mm. longa, 1–1·5 mm. lata, glanduloso-pilosa. *Petala* lanceolato-oblonga, subobtusa, usque ad 1·5–2 mm. longa, 0·75 mm. lata. *Ovarium* 1 mm. altum ; stylis 3, 1 mm. longi. *Capsula* haud ampullacea, 2·75 mm. longa, 1·5 mm. diametro.

Tanganyika. Lushoto District : West Usambaras, Shume Forest, 2 miles S.E. of Manolo, 1800 m., 23 May 1953, *Drummond and Hemsley* 2692 (holotypus in Herb. Kew.).

The following field data are supplied by the collectors : Open grassy area at fringe of *Juniperus–Myrica* upland dry evergreen forest. Small annual ; calyx green ; petals white ; anthers yellow ; filaments white. Stem and leaves with glandular hairs.

Flora of West Tropical Africa.*—The revised edition of this standard West African flora is being prepared by Mr. R. W. J. Keay, who has been seconded to Kew by courtesy of the Nigerian Government, at a time when there is considerable activity in tropical African botany, and the appearance of the first part of volume one will be welcomed by many far beyond the area it covers. In contrast with the multi-volume floras which are in hand for most other regions of tropical Africa, this flora retains the compact and concise qualities of the first edition and strains neither the pocket nor the muscles of the user. Some may argue that the continued absence of generic descriptions detracts from its usefulness, but these would have added considerably to the number of pages and to the time of preparation. Even so, the bulk has been increased by over 40% on the first edition. Part of this is due to an enlarged (and highly preferable) method of citation of localities and herbarium sheets, and partly to additional illustrations, for Miss E. M. Stones has specially drawn a further 17 plates to supplement those drawn by Mr. W. E. Trevithick for the first edition. However, much is also the result of the 27 years of collecting and research that has continued between the publication of the two editions. This is particularly true of the remoter parts of the British Cameroons and parts of the French territories which have yielded interesting, and surprisingly close, affinities with other parts of tropical Africa, especially in the east. In all, about 100 species have been added to the first edition total of 900 species.

Although at first sight there appears to be little difference between the editions, a moment's comparison will reveal that a great part has been completely re-written and re-constructed, not only to accommodate the additional species, but to help the user over a number of difficulties and omissions of the first edition. Such simple aids as having the page-headings bearing the genera on them and the insertion of the illustrations in the relevant section, help the easy use of the flora. A fundamental improvement is the provision of a dated basonym with every double citation, and this might be adopted in all floras with advantage. The key to the families has been omitted from this part and will not appear until the completion of the work.

This part contains 72 families from the Gynospermae to Guttiferae, in Hutchinson's system of classification, which gives a measure of Mr. Keay's industry during the two years he took to prepare it. He is to be heartily congratulated on his fine achievement.

F. N. Hepper.

* Flora of West Tropical Africa. By J. Hutchinson and J. M. Dalziel. Second edition revised by R. W. J. Keay. Volume I, part 1. Crown Agents for Oversea Governments and Administrations ; p. 295, fig. 112, 1954 ; 25/-.

OPERCULATE DISCOMYCETES FROM TRINIDAD AND JAMAICA.

R. W. G. Dennis

The following list records the few operculate discomycetes obtained during the writer's visits to Trinidad, Tobago and Jamaica in the autumn and winter of 1949. So little attention has been paid to these fungi locally that 6 of the 10 species from Trinidad were hitherto unrecorded from the island viz. *Pulvinula etiolata*, *Lamprospora lobata*, *Anthracobia macrocystis*, *Psilopezia jurensis*, *Phaedropezia flavida* and *Phillipsia carnicolor*. Nearly all the species listed have been fully described and figured either by Boudier 1905–10 or in Madame Le Gal's monumental "Discomycètes de Madagascar", works essential to the serious student of operculate discomycetes in any part of the globe. The classification adopted is that of Le Gal (1954).

MORCHELLACEAE

Leptopodia pezizoides *Afz. ex Fr. Boud.* Discom. d'Europe 37 (1907).

Abundant in forest and gardens at 5000–6000 ft., Cinchona, Blue Mts., Jamaica. *Dennis* J54, 54A, 54B. December 1949.

This species, common in Europe, is apparently unrecorded from North America, at least under this name. It might be confused with *Peziza macropus* Pers. ex Fr. but has very different broadly elliptical spores.

Leptopodia atra *König ex Fr. Boud.* Discom. d'Europe 37 (1907).

A single specimen, Cinchona, Blue Mts., Jamaica, *Dennis* J22. 20.12. 1949.

This appears to correspond with the traditional interpretation of this old name in Europe and North America but it must be admitted that the original figure of König's fungus from Iceland is difficult to recognise as the same species.

ASCOBOLACEAE

Ascobolus major *Berk. & Curt.* in Grevillea **4,** 6 (1875).

On cow dung, Hope, Jamaica. *Dennis* J176. 18.12.1949.

St. Augustine, Trinidad, *R. E. D. Baker* 1479. 30.6.1947.

Comparison with the type, from South Carolina, shows this to be a distinctive species well characterised by its large apothecia and smooth elliptical spores, 21–25 × 11–13μ with the epispore showing fine reticulating cracks at maturity. *Ascobolus magnificus* Dodge is probably a synonym and *A. orientalis* Pat. Le Gal is evidently very similar.

Saccobolus neglectus *Boud.* in Ann. Sci. Nat. Ser. 5, **10,** 231 (1869).

On cow dung, Hope, Jamaica. *Dennis* J177. 18.12.1949.

This is an european species, probably widespread but liable to be overlooked because of its small size. The closely allied *S. kerverni* (Crouan) Boud. has been reported from Puerto Rico and Bermuda.

PEZIZACEAE

Galactinia auriformis (*Pat.*) *LeGal*, Discom. de Madagascar, 417 (1954).

On clay soil in forest, near Tabaquite, Trinidad. *F. J. Seaver* 3330, 26.3.1921. This is the collection recorded by Seaver as *Peziza badia* Pers. The type was from Venezuela and LeGal has the species from Madagascar. Its small ribbed spores are very distinctive.

HUMARIACEAE

Pulvinula globifera (*Berk. & Curt.*) *Le Gal*, Discom. de Madasgar 94 (1954).

In swarms on burnt ground beside the Caroni River, Trinidad. *Dennis* 178. 14.10.1949.

The type was from Cuba and Le Gal has the species from Madagascar, Duss reported it from Martinique.

Pulvinula etiolata (*Cooke*) *Le Gal*, Discom. de Madasgar 91 (1954).

On sandy soil in bamboo plantation, St. Joseph, Trinidad. *Dennis* 13. 20.9.1949. The type was from a similar habitat in French Guiana. Le Gal has identified with this a collection on woody debris from Madagascar.

Lamprospora lobata (*Berk. & Curt.*) *Seaver* in Mycologia **6,** 22 (1914).

On sandy soil in forest, Quinam, Trinidad, *R. E. D. Baker* 4.11.1949.

A recognisable figure of the characteristic spores of this species, hitherto known only from Cuba, will be found in the publication cited.

Anthracobia macrocystis (*Cooke*) *Boud.* Discom. d'Europe 65 (1907).

On burnt debris in Bamboo plantation, St. Joseph, Trinidad. *Dennis* 212. 20.10.1949.

Psilopezia juruensis *P. Henn.* in Hedwigia **43,** 273 (1904).

On decorticated log, L'Orange, Aripo valley, Trinidad. *Dennis* 174. 13.10.1949. This species is otherwise known only from Amazonas, Brasil, but it may prove to be no more than a large state of the North American *P. nummularia* Berk.

Phaedropezia flavida (*Berk. & Curt.*) *Le Gal*, Discom. de Madagascar 185 (1954).

On rotting wood, Non Pareil, Sangre Grande, Trinidad. *Dennis* 156. 11.10.1949. The type was from Alabama. Le Gal has the species from Madagascar and thinks *Peziza flavotingens* Berk. & Br. from Ceylon may be a synonym.

SARCOSCYPHACEAE

Pseudoplectania nigrella (*Pers. ex Fr.*) *Fuckel* in Jahrb. Nass. Vereins f. Naturkunde **23-24,** 324 (1870).

On soil beside the trail, under or near pines at c. 4500 ft., Conchona Blue Mts. Jamaica. *Dennis* J175. 21.12.1949.

Explanation of figure

A. *Leptopodia atra*. B. *L. pezizoides*. C. *Cookeina tricholoma* (pink). D. *C. sulcipes*. E. *Phillipsia domingensis* (dark reddish-purple). F. *P. carnicolor* (pale pink). G. *Cookeina venezuelae* ochraceous). H. *Sarcosoma rhytidia*. J. *Pseudoplectania nigrella*. K. *Psilopezia juruensis* (brown). L. *Phaedropezia flavida* (deep yellow). M. *Pulvinula globifera* (light red). N. *P. etiolata* (clay colour). O. *Lamprospora lobata* (fresh colour uncertain). P. *Anthracobia macrocytis* (orange). Q. *Ascobolus major* (disc dark brown, two lower spores taken from the type). R. *Plectania occidentalis* var. *jamaicensis*. S. *Galactinia auriformis* ascospore (apothecium brown).

Apothecia natural size, spores × 660 except in J, K and S which are × 1000, all drawn from specimens cited.

This is a cosmopolitan species described originally from Europe, wide spread in North America and already recorded from Jamaica, sent to Le Gal from Madagascar and reported from Victoria, Australia.

Sarcosoma rhytidia (*Berk.*) *Le Gal*, Discom. de Madagascar 224 (1954).

On fallen twigs of *Eucalyptus* and on dead fern rhachides at 5000–6000 ft., Cinchona, Blue Mts., Jamaica. *Dennis* J19, 19A. 20–26.12. 1949.

This species, well characterised by its peculiarly wrinkled spores, was first described from New Zealand and is known also from Celebes, Java, Madagascar and South Africa. It might be confused in the field with *Rhizopodella melastoma* (Sow. ex Fr.) Richon, a north temperate species, but lacks the distinctive red incrustation of the latter.

Cookeina tricholoma (*Mont.*) *O. Kuntze*, Rev. Gen. Pl. **2,** 849 (1891).

On sticks, River Estate, Diego Martin. *Dennis* 39. 22.9.1949 ; on bamboo, St. Joseph, Trinidad. *Dennis* 85. 26.9.1949 ; Charlotteville, Tobago. 6.12.1949.

The type was from French Guiana and there are collections of the species at Kew from Mexico, Cuba, Santo Domingo, British Guiana, Brasil, Gold Coast, S. Nigeria, Tanganyika, Ceylon, Nicobar Is., Malaya, Sarawak, Philippine Is., north Queensland and the Loyalty Is. Le Gal recorded it from Madagascar and Boedijn from Sumatra, Borneo, Celebes and New Guinea. Duss listed *C. tricholoma* from Guadeloupe and Martinique but not the more conspicuous *C. sulcipes*. Seaver and Chardon (1926) reported both species from Jamaica and Puerto Rico.

Cookeina sulcipes (*Berk.*) *O. Kuntze*, Rev. Gen. Pl. **2,** 849 (1891).

Attached to buried wood in cacao plantation, River Estate, Diego Martin, *Dennis* 40, 22.9.1949 ; Siparia, *Dennis* 282, 3.11.1949 ; Erin, Trinidad, *Dennis* 282A, 6.11.1949 ; Charlotteville, Tobago, 6.12.1949.

The type was from Surinam and there is material at Kew also from Cuba, Santo Domingo, Brasil, Sierra Leone, Gold Coast, S. Nigeria, Cameroun, Ceylon, Malaya, Aru Is., Admiralty Is., Papua and north Queensland. Le Gal had it from Madagascar and Boedijn from Sumatra, Borneo, Java, Celebes, Moluccas and Dutch New Guinea.

A form with brownish hymenium occurs in Trinidad with the typical salmon coloured form, the two are indistinguishable when dried.

Cookeina venezuelae (*Berk. & Curt.*) *Le Gal*, Discom. de Madagascar 241 (1954).

On decorticated wood, Hermitage reservoir, Jamaica 17.12.1949 ; near Morce's Gap, Blue Mts., Jamaica, leg *G. Mills*, 20.8.1949 ; 3000 ft. Chestervale, Jamaica, *L. M. Underwood* 1160, 7.1.1903 ; Sierra Nevada de Santa Marta, Colombia, *G. W. Martin* 3312, 12.8.1935, the two latter in Herb. New York Bot. Gard.

The type was from Venezuela and it is surprising that the species has not been had from Trinidad. Le Gal has shown that Seaver was in

error in treating this as a synonym of *C. colensoi* (Berk.) Seaver but that the true *C. colensoi* with non striate spores and stalked apothecia occurs in south Brasil. *Discina epixyla* Pat. from Guadeloupe seems to be a synonym of *C. venezuelae.*

Phillipsia domingensis (*Berk.*) *Berk.* in J. Linn. Soc. Bot. **18,** 388 (1881).

On dead wood beside forest trail at about 1500 ft., hills north of St. Augustine, *Dennis* 331, 13.11.1949 ; Mt. Tabor, Trinidad, Leg. *W. T. Dale*, I.C.T.A. 1853, 14.12.1947 ; La Victoria, Trinidad, *E. M. Wakefield* 244, 18.1.1921.

The type was from Santo Domingo and there is material at Kew also from Cuba, Sierra Leone and Natal, South Africa. Le Gal had it from Madagascar and Boedijn from Sumatra and Java.

Phillipsia carnicolor *Le Gal*, Discom. de Madagascar 418 (1954).

On dead stick half buried in sandy soil, Forest north of Erin, Trinidad, *Dennis* 310, 6.11.1949.

Plectania occidentalis (*Schw.*) *Seaver*, N. American Cup Fungi 193 (1949) var. **jamaicensis** var. nov.

A typo differt hymenio rubro (" Congo Pink " Ridgeway).

On dead stick in forest litter, path to Morce's Gap, Cinchona, Blue Mts., Jamaica, *Dennis* J65, 25.12.1949.

Boedijn, K. B. 1933. Bull. J. Bot. Buitenzorg Ser. 3, 13.

Boudier, E. 1905–1910. Icones Mycologicae., 4 Vols. Paris.

Le Gal, M. 1954. Flore mycologique de Madagascar 4 Les Discomycètes de Madagascar.

Seaver, F. J. & Chardon, C. E. 1926. Scientific Survey of Porto Rico 8 pt. 1.

Drawings of British Plants.*—Another part of this work has now appeared and, like those already published, is well produced, maintaining the high standard set in previous issues. Part VII deals with the Leguminosae and contains 76 drawings executed with the usual high skill of Miss Ross-Craig, who is to be congratulated on the completion of yet another part of this excellent series of drawings. As in previous issues plants are drawn natural size and the various parts of the flower, fruit, etc., clearly shown in an enlarged form. The common name and the colour of the flower are given in the legend under each plate. All interested in the plants of these islands will welcome this further contribution to their study.

H. S. MARSHALL.

* Drawings of British Plants. By Stella Ross-Craig. Part VII. Leguminosae (76 plates). 1954. Price 12/-. London : G. Bell & Sons Ltd.

HEIMIOMYCES IN THE OLD WORLD TROPICS.

R. W. G. Dennis

Heimiomyces Singer was founded on *Agaricus rheicolor* Berk., subsequently shown to be a synonym of *A. tenuipes* Schwein. The genus is well characterised by itsCollybioid habit combined with subhymeniform epicutis, gelatinised trama and strongly amyloid spores. The type species, *H. tenuipes* (Schwein.) Singer is abundant throughout the Americas from the Great Lakes to Argentina, two other species have been described from Argentina and one from the Pacific coast of N. America but hitherto *Heimiomyces* has been regarded as a peculiarly American genus. It does, however, occur sporadically both in Africa and in Asia, where old collections have passed as *Collybia velutipes* (Curt. ex Fr.) Kummer, the type species of *Flammulina* Karst. The following are indistinguishable in the dried state from *H. tenuipes* :—

Africa, Congo, Jardin Botan. d'Eala, 1923, Goossens 320, typus of *Tricholoma flammulaecolor* Beeli ; Kenya, Central Province, indigenous forest between Hombe and Niaria Hill, above Nyeri, 6500 ft., on dead wood of *Cassipourea elliotii*, 12.XI.1951, *R. W. Rayner* 510.

Asia, Sikkim 1845 *J. D. Hooker* 25 ; United Provinces, Mussoorie, on rotting stump, 16.VII.1950, *K. Grinling* 13.

J. M. Wood 486 from Inanda, Natal, South Africa, cited by Doidge (Bothalia 5 p. 557) as *C. velutipes* is neither this nor a *Heimiomyces* but an *Oudemansiella* with spores 17 μ diameter, probably another example of *O. canarii* (Jungh.) von Höhnel, described in Kew Bull. 1952, pp. 459–461. On the other hand, the presence of some species of *Heimiomyces* in Australia is indicated by a collection from Brisbane, Queensland, which Cooke passed as *Marasmius cauticinalis* Fr. This has the cellular epicutis, gelatinous trama and strongly amyloid spores 6–7·5 × 4μ but apparently lacks the downy hairs which occur on the pileus of *H. tenuipes*.

THE AECIDIUM REPORTED BY COOKE ON POTERIUM SANGUISORBA.

R. W. G. Dennis and N. Y. Sandwith

In Journal of Botany 2 p. 39, 1864, Cooke published a diagnosis of *Aecidium poterii* n.sp., said to occur in May and June at Dartford Brent, Kent, on leaves of *Poterium sanguisorba*. Caeomata of *Phragmidium sanguisorbae* (DC.) Schroet. are common on this host but no one else has reported a true aecidium on it. In " The British Rust Fungi " p. 387 1913, Grove duly compiled *Ae. poterii* Cooke with the comment "a species of which nothing else seems to be known ". Had he troubled to consult Cooke's herbarium at Kew the mystery would have been solved. Here is ample material labelled "Aecidium poterii, Darenth, May 25, 1863." Darenth is a parish on the outskirts of Dartford and this is evidently the collection selected by Cooke as representative of his new species published the following spring. It bears true aecidia in abundance but the leaves are those of *Pimpinella saxifraga* and the rust is *Puccinia pimpinellae* Mart., of which *Ae. poterii* must be regarded as a synonym.

A FORGOTTEN BRITISH FUNGUS.

R. W. G. Dennis

Cantharellus houghtoni Phillips was published by Berkeley and Broome as number 1565 of their Notices of British Fungi, in Annals and Magazine of Natural History, Ser. 4, 17, p. 135, February 1876. The origin of the material was given as " Hereford, W. Phillips and others " and the specific epithet was not explained though one of Berkeley's specimens is labelled " Rev. W. Haughton ". The locality cited was evidently misleading for the report of the 1876 Woolhope foray records on that occasion " *Cantharellus Houghtoni*, an exquisitely beautiful plant named by Mr. Berkeley in honour of the Rev. W. Houghton who brought the fungus to Hereford last year and again this year ". Houghton was rector of Preston, near Wellington, Shropshire, which is presumably the type locality. One may even make a closer guess at its origin. Cooke's drawing of *C. houghtoni* was annotated in his own hand " On Sambucus and other wood " which suggests that this may have been the collection referred to by W. G. Smith in his account of the 1875 Woolhope foray at Hereford as " *Cantharellus Friesii*, new, found by Master Arthur C. Houghton on an elder tree in Mr. Spearman's garden at Preston Weald Moss, Wellington Salop ". In any case it appears that the material labelled " *Cantharellus Houghtoni* " or " *Haughtoni* " in Berkeley's herbarium can be accepted as authentic for the name.

The species was listed again from the Woolhope foray in 1879 and its locality is given as Holme Lacy in the Hereford Flora (1889), Worcestershire naturalists listed it from Trench Woods on 25th Oct. 1894 but since then it seems to have been lost sight of except for a single unconfirmed record from Fordoun, Kincardineshire, by J. Mason. (Ann. Scot. Nat. Hist. 1905, p. 178). *C. houghtoni* was unknown to Rea when he published British Basidiomycetae in 1922 and neither he nor René Maire ventured any opinion on its identity in their well known commentary on Cooke's Illustrations of British Fungi. Quélet thought it a synonym of his own *Marasmius incarnatus*, 1886, but this too is listed among the " Espèces doubteuses ou insuffisamment connues " by Konrad & Maublanc and finds no place in the modern French flora of Kühner & Romagnesi.

On 8th and 13th October 1950 Mr. P. Orton collected large quantities of an attractive but unfamiliar pale pink agaric in the woods at Norbury Park, Mickleham, Surrey and sent them to the late A. A. Pearson who described them in 1952 as a new species of *Omphalia*, *O. roseotincta* Pearson. Further collections from the type locality were sent to Kew in November 1953.

Comparison of descriptions, figures and authentic material of *C. houghtoni* and *O. roseotincta* leaves no doubt that they are identical. The two diagnoses are tabulated below, amplified by personal observations on the dried specimens and comments on the figures in Grevillea Plate 76 Fig. I.

Cantharellus houghtoni	*Omphalia roseotincta*
Pileus 1–2 inches across, thin.	Cap 1–4 cm., subfleshy, elastic, hygrophanous.

Convex, umbilicate, glabrous, dirty white with a tinge of flesh colour.	Convex or flat, umbilicate, smooth, pale pink drying to white.
(Margin undulating, crenulate and splitting, not striate).	Margin incurved at first, crenulate, often plicate, striate when moist, opaque when dry.
Gills narrow, scarcely forked, pale pink, subdecurrent (edge even).	Gills crowded, very narrow, arcuate or linear, decurrent or subdecurrent, unequal, elastic, rather thick, pale pink, edge smooth.
Stem 2 inches high, 1 line thick, rooting at the base which is more or less cottony, slightly thickened above, minutely fibrillose, stuffed, (white to cream coloured).	Stem 2–5 cm. × 2–5 mm., very cartilaginous, equal or tapering to an acuminate base, with tuberous swelling at apex near gills, hollow, white or pink, sometimes yellowing when old.
(Flesh white, nonamyloid). (Spores broadly ovoid, 5–6 × 3–4μ, smooth, nonamyloid).	Flesh white (nonamyloid). Spores broadly ovoid, 5½–6 × 3½–4 μ, smooth, nonamyloid.
(Gill edge fertile, no cystidia).	Gill edge fertile, no cystidia.
(Basidia 20–25 × 4–5, 4-spored).	Basidia 30–35 × 5½–6μ, 4-spored (But only 20–24 × 4–5 μ in dried material).
(Cap surface of cohering, subparallel, hyaline, thinwalled hyphae about 3μ wide).	Cap surface with closely intertwined hyphae 5–6μ thick (about 3 μ in soaked up dried material).
(Some specimens attached to sticks, others with soil on base of stem).	In troops on ground or attached to sticks.

Berkeley & Broome originally published the name as *C. Haughtonii* Phill. and of the four pencil labels in Berkeley's hand two appear to read " Haughtonii " and two " Houghtoni ". Similarly the numbered label on the herbarium sheet written by Berkeley in ink reads " 1750 Cantharellus Houghtoni Phill." whereas the corresponding entry in his manuscript list of collections is equally clearly " 1750—Haughtonii Phill." When Cooke compiled the species in Grevillea, September 1876, he changed the spelling to " Houghtoni " and in the second edition of his Handbook of British Fungi it was explained as being " in honour of Rev. William Houghton M.A." There seems no reason to suppose more than one species was intended by these divergent spellings and " Haughtonii " was presumably an error.

The publication of the fungus in *Cantharellus*, in spite of its well developed gills, is explained by the comment " allied to *C. albidus*" printed after the diagnosis. *Cantharellus albidus* Fr. is referred by modern authors either to *Clitocybe* or, more critically, to *Hygrophoropsis* (Schroet.) R. Maire. *C. Houghtoni* does in fact bear considerable resemblance both to this and to the common *C. aurantiacus* Wulfen ex Fr. the type species of *Hygrophoropsis*.

Omphalia (Fr.) Kummer, to which Pearson referred his *O. roseotincta*, is generally rejected as a later homonym of *Omphalea* L. 1759 and *Omphalia* S. F. Gray 1821 and it is unlikely that many modern mycologists would regard the present fungus as congeneric with *Agaricus umbelliferus* L. ex Fr., the type species of *Omphalina* Quél. Hence, as *Hygrophoropsis* has not become widely accepted and *Clitocybe* is still commonly rather widely interpreted, I propose to transfer *Cantharellus houghtoni* Phill. to the latter genus as **Clitocybe houghtoni** (*Phill.*) *Dennis* comb. nov., with *Omphalia roseotincta* Pearson and probably *Marasmius incarnatus* Quél. as synonyms.

Rhodesian Wild Flowers.*—There is undoubtedly a demand in African territories for books of a popular nature dealing with the common wild flowers. Both residents and visitors alike wish to know the names of the characteristic and more conspicuous flowers of their district, and some are interested in learning their relationship, if any, to well-known garden flowers and to wild flowers from South Africa, Europe, or elsewhere. Whilst books containing descriptions and black and white illustrations would be helpful, there is no doubt that the greatest need is for coloured illustrations.

In " Rhodesian Wild Flowers " an attempt has been made to meet this need, so far as Southern Rhodesia is concerned. But to try to deal adequately with the flowering plants of such a large and varied territory in one volume is to attempt the impossible. When one considers that Mr. Martineau has described less than 300 flowering plants from a flora which probably includes nearly twenty times that number of species, and that, of those described, Mrs. Phear has painted less than half, one will not be surprised when a common and conspicuous plant found near ones home at say Hartley or Umtali is not to be found in the book. For instance the terrestrial orchids, which are very plentiful in Southern Rhodesia and always attract attention, are covered by the descriptions and illustrations of only three species, of which, incidentally, the portrait of *Platycoryne buchananiana* is quite unrecognizable, whilst the epiphytic members of the family escape mention. Again the mistletoe family, containing many conspicuous and beautiful partial parasites of trees and shrubs is covered by a descrption without an illustration of but a single species. One cannot help feeling that the title "Some Southern Rhodesian Wild Flowers" would have been more apposite.

Whilst in a book the size of Mr. Martineau's it is obviously not possible to cover adequately even the more conspicuous flowering plants of Southern Rhodesia, it is felt that more plants could have been included had the paragraphs dealing with plant collecting and identification been omitted. Such information, if required by the reader, can be obtained quite inexpensively in other works. Besides, many of the " simplified "

* Rhodesian Wild Flowers, by Robert A. S. Martineau, illustrated by Margaret A. Phear. Pp. xi — 100 and tt. 35. Published for the Trustees of the National Museums of Southern Rhodesia by Longmans, Green & Co. at 2 guineas.

morphological definitions of the parts of plants are inaccurate and misleading. For example, the root is described as a source of the plant's nourishment ; the stock is roughly what is left over from the previous year, in the case of a perennial plant, and consists of matter both below and above ground ; the flower consists of four rings—called "whorls", not all of which may be present in any particular flower. It is difficult to understand how these sloppy definitions are supposed to assist the beginner.

Mr. Martineau has taken care to obtain the correct scientific names for the plants mentioned in this work, and has been helped in this by botanists both in Southern Rhodesia and at Kew. The popular spelling, *Clerodendron* is however used in place of the correct *Clerodendrum*.

The illustrations, it is felt, do little justice to the original paintings of Mrs. Phear. In many cases the colours are far from correct whilst the the registration is decidedly inaccurate. Considering the high price of the book, one would have expected a higher standard of reproduction of the paintings, which form such an important feature of this work.

A few of the illustrations fail to portray the appearance of the plants. *Erica johnstoniana* (Plate 5) is quite unlike a heath, and reminds one of a thyme covered with galls ! Those who are familiar with *Orobranche minor* would never recognize it as shown on Plate 27, Figure 1. The twisted stem of *Clematopsis* (Plate 30) and the inverted inflorescence of *Sebaea* (Plate 23) are unfortunate examples of artistic licence, whilst *Polygala africana* (Plate 14) can only be described as an impression. Most of the illustrations, however, are a good likeness of the plants, and will undoubtedly assist the reader.

Production of the letterpress is excellent, and errors are few and far between. The caption of Plate 29 is incorrect, as Figure 2 is not remotely like a *Blepharis* and Figure 3 is a species of *Thunbergia*, and not *Crabea velutina*. On Plate 12, the names of Figures 2 and 3 should be interchanged.

If, however, Mr. Martineau's book helps to stimulate Rhodesians to love and appreciate the wild flowers of their country, the time and trouble spent on its production will be well rewarded.

Simple Rose Growing.*—Written by one who has had considerable experience of rose growing, this book gives in simple language, clear cultural instructions for all lovers of the rose.

This new edition is well illustrated with line drawings and photographs and includes a completely revised list of recommended varieties among them many which were introduced in recent years.

H. S. Marshall.

* Simple Rose Growing. By A. G. L. Hellyer. London : W. H. & L. Collingridge Ltd. 1954. Pp. 112 ; price 7/- net.

AN ANATOMIST'S VIEWS ON ANGIOSPERM CLASSIFICATION.

by

C. R. METCALFE.

INTRODUCTION.

It is a familiar fact that no two individual flowering plants belonging to any one species are exactly alike. Still less do they resemble one another when their affinities are more remote. Furthermore, angiosperms, like all living organisms, are in a state of physiological and biochemical flux so long as they remain alive, the changes that take place in their material substance being controlled partly by heredity and partly by environment. In spite of these metabolic changes, the sequence of events in the life history of an angiosperm follow a well defined plan, but genetical changes, permit new combinations of characters to arise in succeeding generations. Thus organisms are produced that are unlike their ancestors to a greater or smaller extent, and this continual process of recombination represents the spearhead of evolutionary advance. This evolutionary 'progression', if indeed it may be regarded as such, is continually taking place in all angiosperms before our very eyes, and leads to ever-increasing diversity of morphological form. It should be noted, however, that the power to produce new forms of flowering plants in these ways is definitely limited, and no really major changes such as those that distinguish one family of angiosperms from another have ever been seen to occur.

Bearing this background in mind, it is the task of the taxonomist to arrange these plastic, ever-changing organisms in a system that not only makes it possible for them to be identified, but the arrangement should also be one that reflects their natural affinities. It has always been customary to rely on the morphology of organs concerned with the sexual reproduction and dissemination of each species for purposes of classification. There is a tradition, based on long experience, that the morphology of flowers, fruits and seeds provides more reliable criteria for purposes of classification than does the morphology of other parts of the plant body. It is further maintained that reproductive structures are less plastic than other parts of the plant body. The minor variations that occur in leaves from different parts of an individual plant, or in leaves of plants from any one species growing in different conditions are pointed out as providing evidence of the taxonomic unreliability of vegetative organs. The less succulent structure that some halophytes assume when grown where they have access to less salt than usual is cited as another example of the type of change that causes difficulties to the taxonomist. Then again there is a common belief that any taxonomic arrangement based on morphological, or micromorphological, characters will be quite different from a system based on the characters traditionally employed by the herbarium botanist. This would indeed be true if none of our existing classifications were in any sense natural, and if they represent no more than convenient pigeon holes for the grouping of plants. It must be remembered, however, that imperfect though our systems of classifications may be, they are natural at least in part. In practice it can be shown that micromorphological characters of the vegetative organs, when used for taxonomic purposes, lead to conclusions that

show a large measure of agreement with those of the taxonomist who uses traditional methods. There is thus little evidence to support the fears of those who think a classification in which micromorphological characters are taken into consideration must necessarily be artificial. It would be possible to make a wholly artificial classification based solely on micromorphology, but this would be possible also with the morphological characters used in traditional taxonomy. Other objections to micromorphological investigation in taxonomic research come from those who have not the time for work of this kind, or who say that they are not interested in the major taxonomic groups, being fully occupied with the boundaries between species or taxa of lower rank. With regard to these criticisms it must be admitted that a busy herbarium botanist who feels almost overwhelmed by the prolific flora of an undeveloped country can scarcely be enthusiastic at the suggestion that he should examine the microscopical structure, as well as the exomorphology, of the plants with which he has to deal. The solution to this dilemma would appear to be for the comparative anatomist to place his knowledge at the disposal of his taxonomic colleagues in the hope that they will at least give sympathetic consideration to his suggestions. There are now so many approaches to taxonomy that collaboration between specialists is more than ever necessary if significant advances in knowledge are to be made. For the taxonomist interested solely in species and taxa of lower rank it must be admitted that micromorphology, except in so far as this term is applicable to chromosomes, is not likely to have a wide appeal.

Phylogeny.

(*a*) *General Considerations*

It is a generally accepted and basic belief amongst anatomists that the tracheid is ancestral to the vessel element. For this reason, flowering plants in which the tracheal elements in the wood consist wholly of tracheids are particularly interesting, and families or genera that exhibit this homoxylous type of wood are regarded as primitive. Beyond remembering that this small but important group of Dicotyledons exists, we need not consider them further in the present discussion. Evidence that the vessel element has been evolved from the tracheid is afforded by the ontogenetic development of vessel elements from tracheids, and by the demonstration that vessel elements appeared more recently than tracheids in the geological record. It is concluded from the work of Professor I. W. Bailey (1) (2) and his associates, however, that this change has occurred more than once in the course of evolution, so that the vessels in Pteridophytes, Gnetales, Dicotyledons and Monocotyledons are pictured as having had separate origins. Apart from the fact that the tracheid is ancestral to the vessel, it has for some years been accepted amongst anatomists that vessel elements with scalariform perforation plates in the end walls are ancestral to those with simple perforations. This evolutionary change has been accompanied by a shortening of the vessel elements, whilst the perforated end walls, instead of being oblique, have become progressively more transverse. It thus follows that the short, barrel-shaped vessel elements that occur in certain of the Leguminosae represent a very advanced type. Other characters of the secondary xylem that are constantly correlated with each of these

stages in tracheal evolution are themselves regarded as showing stages in phylogenetic development. Thus wood fibres with conspicuously bordered pits (fibre tracheids), being more tracheidal in structure than are wood fibres with simple pits (libriform fibres), are regarded as the more primitive of these two types of cell. Other character sequences that demonstrate evolutionary advance are also well known.

The examples of phylogenetic trends that have just been mentioned are well known and commonly accepted. The consequences of applying this principle in angiosperm classification are less widely realized. In the first place Metcalfe and Chalk [3] have recorded that there are some 110 families of Dicotyledons in which vessels with scalariform perforation plates are known to occur. The scarlariform plates occur exclusively or predominantly in some of the families, in others they are infrequent or sporadic. With some exceptions e.g. certain species of Dipsacaceae, Labiatae and Ranunculaceae (*Paeonia*), the families in which scalariform plates occur consist of woody plants. It is thus evident that there are numerous families in which vessel elements of a primitive type exist, and furthermore it must be emphasized once more than these families consist of woody plants. The interesting point is, however, that the families in which this ancestral type of vessel element occurs do not, as one might have expected, constitute a closely allied group. On the contrary scalariform perforation plates are characteristic of such a mixed assortment of families as Betulaceae, Bixaceae, Cornaceae, Ericaceae, Magnoliaceae, and Theaceae to cite but a few examples. This very diversity of families with primitive vessel elements indicates that they have evolved independently for a very long time. Since it is already held that the scalariform type of vessel element has been evolved more than once, the question naturally arises of whether the angiosperms can have had more than one evolutionary starting point. It may in fact be that many of the past controversies concerning angiosperm phylogeny have arisen because of the attempt to derive all of them from a single archaetype.

It is generally agreed that when the rays or elements of the secondary xylem are arranged in horizontal rows as seen in tangential section (storied structure), this may be regarded as a specialized character. Storied rays occur in some 28 families, again including such diverse types as Bignoniaceae, Boraginaceae, Compositae, Ebenaceae, Leguminosae, Meliaceae, Ulmaceae and Zygophyllaceae. Storied rays are commonly restricted to certain genera and species within each family, so that this character provides evidence of phylogenetic advance within families, besides indicating in which families specialization has occurred. Since there is no evidence to suggest that all of the families in which storied structure occurs are closely allied to one another, it must be concluded that horizontal seriation of the elements is an advanced character that has been evolved several times over, and affords a good example of parallel evolution within the angiosperms.

Cheadle's [4] work on the tracheal elements in the metaxylem of the Monocotyledons has shown that the change from tracheids to vessels has occurred first in the roots, subsequently in the aerial stem and finally in the leaves. Evidence of this is afforded by the fact that there are numerous Monocotyledons in which vessels are confined to the roots, the conducting elements in the remainder of the plant being tracheids, e.g. in the

Alismataceae. All intermediates between these types of arrangement and one in which vessels occur throughout the plant, e.g. in the Gramineae, occur in different Monocotyledons. These observations of Cheadle's have been extended in recent years by work at the Jodrell Laboratory, where it has been shown that Cheadle's observations hold true in other families such as the Xanthorrhoeaceae which he has not examined very completely. One consequence of this work is the demonstration that the vascular bundles in the Ranunculaceae, although not unlike those of the Graminaeae, differ considerably from those of the Alismataeceae, notably in having vessels in the aerial parts of the plant. It seems difficult to imagine that there can be any close connection between the Gramineae and Ranunculaceae, and the difference in vascular structure also indicates that the Alismataceae cannot be closely allied to either family. If there is indeed a direct connection between the Monocotyledons and Dicotyledons it must be sought elsewhere. Furthermore it may be noted that the vascular structure of the Ranunculaceae is a more advanced type than that of the Alismataceae, so that the phylogenetic change from Ranunculaceae to the less specialized Alismataceae is scarcely likely to have taken place. The similarities between the 2 families, including the occurrence of only one cotyledon in *Ranunculus ficaria* and *Eranthis* must be interpreted as parallel developments.

(*b*) *Relationship of Herbs to Ligneous Plants.*

It is commonly stated that herbs are more specialized in their vascular structure than are woody plants. This in turn is thought to indicate that herbs have been derived from woody ancestors. There is very strong evidence that this must, in part, be true, and it seems very probable that the herbaceous habit is, for many species, a specialization that enables them to exist in temperate or arctic conditions. On the other hand ligneous plants are to a large extent dominant in the tropics. It must, however, be remembered that, if the Monocotyledons are taken into consideration, unspecialized vascular structure occurs in herbaceous species. Furthermore the term herb is used, even by botanists, in a rather popular sense, to cover any plant in which there is no great development of xylem. If the vascular structure is taken into consideration it becomes clear that herbaceous species of, for example, *Linum* and *Veronica*, with a closed cylinder of xylem and phloem in the stem internodes, are rather different from a species of *Ranunculus* with its widely spaced, discrete vascular bundles in the corresponding position. It is interesting to speculate whether the phylogenetic history of these two types of herb has necessarily followed the same sequence, but it seems at least not impossible that the more fundamentally herbaceous angiosperms may never have had strongly ligneous ancestors.

(*c*) *The Durian Theory.*

The Durian theory was put forward by Mr. E. J. H. Corner (6) of Cambridge, after prolonged observations and much cogitation in tropical countries. According to the theory, large arillate seeds in massive fruits are ancestral to other types. No plant other than a tree could carry such massive fruits, and tropical conditions provide the most suitable environment for the successful functioning of large fruits. Hence, according to

this view, ancestral angiosperms were tropical trees, pictured as resembling Cycads in habit, since thin branches are not well adapted for carrying heavy fruits. These pachycaulous trees probably had large compound leaves of pinnate type, and these are thought, in the course of evolution, to have given rise first to palmate and then to simple leaves. The leptocaulous or branched trees have been evolved from those of pachycaulous habit, and there has been a corresponding reduction in the size of fruits and seeds. Cauliflory, the production of flowers on relatively thick woody stems, is a specialization whereby advanced leptocaulous plants can retain massive fruits. It is pointed out that although microspermous trees can exist in tropical conditions, as one proceeds to temperate, and still more to arctic, regions, microspermous seeds are increasingly dominant.

This very plausible theory may quite well be partly true. Large arillate seeeds may be an ancestral type, but if we can agree that angiosperm phylogeny has not proceeded exclusively along one line, there is no reason to suppose that large arillate seeds are the only primitive type. Is there any reason why microspermous and megaspermous seeds cannot have co-existed from the earliest times, or why the pachycaulous and leptocaulous habits may not have arisen independently.

It is, however, when the Durian theory is considered in relation to the phylogenetic tenets of the anatomist that other difficulties begin to arise. If the Durian theory is compatible with the now widely accepted fact that vessels with simple perforations have been evolved from those with scalariform plates, one would expect to find scalariform plates in plants that have specially large seeds and fruits. Similarly as the fibre-tracheid is regarded by the anatomist as being ancestral to the libriform fibre, one would expect fibre-tracheids to be associated with specially large fruits and seeds. What then do we in fact find. The data recorded by Metcalfe and Chalk (8) enable a comparison, although an imperfect one, to be made. First it may be noted that the Durian (*Durio zibethinus*) itself, the species from which the theory takes its name, possesses simple perforations, and not the ancestral scalariform plates that its supposedly primitive status would appear to demand. On the other hand some of the Myristicaceae and all of the Stachyuraceae, the 2 families quoted by Corner as having arillate seeds in all genera and species, also exhibit scalariform perforation plates. Fibre-tracheids occur in Stachyuraceae, and there is a tendency towards the formation of fibre-tracheids in Myristicaceae, but the borders to the pits are less conspicuous. Many, but not all, of the Dilleniaceae and a few of the Passifloraceae, two families in which the seeds of most genera are arillate, likewise have scalariform plates, and fibre-tracheids are common in both families. In the Connaraceae, on the other hand, the vessel perforations are exclusively simple, although the seeds are often arillate. Of the families mentioned by Corner as including many genera with arillate seeds, the Meliaceae and Sapindaceae have simple perforations, and certain members of the Celastraceae, Flacourtiaceae and some Melianthaceae and Guttiferae have scalariform plates. In the Nymphaeaceae, a family including 2 genera with arillate seeds, the tracheal elements are tracheids. Scalariform perforation plates, which are rather uncommon in most of the families concerned, and arillate seeds occur in at least a few genera of

Apocynaceae, Berberidaceae, Elaeocarpaceae, Lecythidaceae, Linaceae, Monimiaceae, Rhamnaceae and Rhizophoraceae. On the other hand only simple perforations are known in Aizoaceae, Annonaceae, Bombacaceae, Malvaceae, Melastomaceae, Papaveraceae, Sterculiaceae and Thymelaeaceae, although a few genera with arillate seeds are known in all of these families. It is interesting to note that *Paeonia*, is the only genus of Ranunculaceae, if it should be included in this family, in which scalariform plates and a rudimentary aril are both present, whereas most families listed by Corner as having a rudimentary aril e.g. Bixaceae, Cactaceae, Fumariaceae, Oxalidaceae, Papilionaceae and Polygalaceae have simple perforations to the vessels. The barrel-shaped vessel elements that occur in some Papilionaceae are a distinctly advanced type.

This comparison shows that, although scalariform plates and arils sometimes occur in the same families, there are some notable exceptions. Furthermore, as the aril becomes reduced, the scalariform plates tend to disappear. The fact that rudimentary arils are more often associated with simple perforations than with scalariform plates suggests that the aril has been, or is being, eliminated more slowly than the scalariform plate. Families in which rudimentary arils and scalariform plates both occur are Euphorbiaceae (in part), Tremandraceae, Turneraceae and Violaceae.

Data recorded by Metcalfe and Chalk (loc. cit.) also enable a comparison to be made between the occurrence of plants with micro- and megaspermous seeds on the one hand and different types of perforation on the other. Such a comparison enables it to be seen at once that scalariform plates are by no means confined to families in which large seeds and fruits occur. To mention but a few examples, Betulaceae, Brunelliaceae, Buxaceae, and Empetraceae, which have scalariform perforation plates, at least in certain genera and species, cannot be described as having either large seeds or fruits. Conversely certain families such as Caesalpiniaceae, in which large fruits and seeds occur, have exclusively simple perforations. Indeed Caesalpiniaceae is one of the families of which certain members exhibit horizontal seriation of the elements (storied structure), which the anatomist has come to regard as an advanced character.

How then are these facts to be interpreted, for some of them appear to be not incompatible with the Durian theory, whilst others clearly are not ? In this connection it may be noted that, in any one species, some characters could quite well attain a high level of phylogenetic specialization before others have done so. Thus, if the Durian theory be true, or at least partly so, it is quite possible that *Durio zibethinus* itself, while retaining the ancestral type of fruit and seed, has progressed in its wood structure from the scalariform plate to the simple perforation. Pending the discovery of concrete evidence that the Durian in fact retains primitive characteristics, Corner's theory must be regarded as tentative. The evidence of comparative anatomy seems to support it to a certain extent, and the primitive angiosperm depicted by Corner could quite well be one of the starting points of angiosperm evolution. But to the anatomist, at least, it seems that it is unlikely to be the sole starting point. Incidentally, it is most interesting to note that Sporne (9), by an entirely

different method of reasoning from that adopted by Corner, has concluded that the possession of arillate seeds is one of a number of characters that can be regarded as primitive.

Taxonomy

(*a*) *Taxa above the rank of family.*

If the diagnostic microscopical characters for nearly all groups above the rank of family are recorded in tabular form, it is immediately evident that orders, and taxa of still higher rank, are heterogeneous. This has been done at Kew for the respective systems of Bentham and Hooker, Engler, and Hutchinson. The same heterogeneity is to be observed no matter which of these systems is involved, although the orders in Hutchinson's system are slightly more homogeneous than those in the respective systems of Bentham and Hooker and Engler. From this we may conclude that orders are probably, for the most part, taxonomic conveniences rather than assemblages of related plants. There are exceptions such as the Centrospermae which appear to the anatomist to be more or less homogeneous and therefore natural.

(*b*) *Genera.*

If the diagnostic characters of genera in individual families are tabulated the result is quite different from that obtained with orders. Most of the families appear to be homogeneous and therefore natural. There are exceptions, and, where there is a lack of uniformity in the diagnostic microscopical characters this generally indicates that some taxonomic revision is desirable, or that a large family needs to be divided into distinct groups. Numerous examples of families in which taxonomic revision is desirable, or of families between which the anatomy indicates that there are affinities, are given by Metcalfe and Chalk (8) under the "Taxonomic Notes" referring to each of the families concerned. The following are a few examples selected to indicate the types of changes that appear to be needed.

(i) The Euphorbiaceae, which many taxonomists would agree includes a rather unwieldy collection of miscellaneous plants, is very heterogeneous anatomically. Indeed, in dealing with the wood structure of the arboreal genera alone, Chalk found it necessary to divide genera into groups of which the members had sufficient characters in common to permit useful descriptions to be written. (ii) The Menyanthaceae are so unlike the Gentianaceae in structure that it seems logical to treat them as distinct families. (iii) The Ternstroemiaceae, as understood by Bentham and Hooker, are only partly homogeneous, and the reduction of the family to Theaceae as understood in the Engler system is a marked improvement from the anatomical standpoint. Examples of pairs of families between which the anatomy confirms that there must be close affinities are (iv) Hypericaceae and Guttiferae. (v) Caryophyllaceae and Illecebraceae.

When one considers the anatomy of the genera in any one family the boundaries between them are not very clearly defined. This applies particularly in such families as the Sapotaceae and Dipterocarpaceae where the genera are difficult to separate by any method, either anatom-

ical or otherwise. Similarly, examples could be cited of large dicotyledonous families where the constituent tribes do not fall into well defined anatomical groups. In the Gramineae, on the other hand, the genera tend to fall into definite groups on the basis of differences in the epidermal characters of the leaves, particularly on differences in the micromorphology and distribution of silica bodies, the shapes of the subsidiary cells of the stomata, and the presence or absence and form of the mostly 2-celled micro-hairs. Similarly, recent work at Kew has shown that there are microscopical characters whereby the Costoideae and Zingiberoideae can be distinguished.

(*c*) *Species*

As already indicated, species cannot be readily distinguished by microscopical differences unless the genus is first established. The restricted value of anatomy at the species level is partly due to intraspecific variation in structure, and partly to similar variations in more than one genus. An example of the second type of difficulty can be taken from the Gramineae. Thus a transverse section of a leaf of *Stipa hookeri* Stapf strongly resembles a similar section of a leaf of *Ammophila arenaria* (L.) Link. Even when the identity of the genus has been established by traditional methods the anatomical separation of species is often by no means easy, especially where one is dealing with a large genus in which the species are rather alike. The identification of species is, however, much easier when one, or a limited number, of species of any one genus are known to occur in the area in which the material was collected. Also where a limited number of species are used for a definite economic purpose. For example the species of *Barosma* or of *Digitalis* that are used in medicine can be identified by the structure of their leaves.

(*d*) *Intraspecific Variation.*

(i) Structure in relation to environment.

It has always been debatable, when minor structural variations occur, whether these are controlled by heredity, environment or a mixture of both. Experimental work has shown that such characters as the number of layers of palisade cells in a leaf can vary with the light intensity, and that the degree of succulence can be controlled by the amount of salt in the soil. There are also other quantitative characters such as the number of stomata per unit area, and the exact thickness of the cuticle that appear to vary with environment. None of these changes, however are great enough to modify the basic hereditary structure of the plant in which they occur. Studies on the autecology of individual species show, however, that even minor intraspecific variations have a genetical background, and the same point is made abundantly clear by the large amount of genetical work that has led to the production of superior varieties of economic or ornamental plants. Since these minor variations are basically hereditary, any larger ones are still more likely to be controlled by nature rather than nurture. If the hereditary structure of a particular group of plants is such that it enables them to flourish, or even to become dominant over others with which they are in competition, in a specialized environment, this very fact may give rise to the illusion that the advantageous structure has arisen in response to the rigours of the

environment. It is true that characters that enable a plant to grow in an environment that would be unsuitable for plants in which the same characters are not developed can be regarded as ecological specializations. Nevertheless they are, in all probability, primarily hereditary and secondarily of ecological value.

In developing this theme, attention must be directed to certain well known facts that are frequently overlooked. For example, amongst the Cactaceae, although most members of the family inhabit areas of low or intermittent rainfall, where their specialized structure gives them an ecological advantage, it must be remembered that other members of the same family occur as epiphytes on trees in a very moist environment. Nevertheless, members of the Cactaceae from both types of environment exhibit the same basic hereditary structure, with succulent, assimilatory stems, and spines. It so happens that this type of structure enables the plants in which it is exemplified to grow successfully in competition with mesophytic plants in a dry environment, and so we have the illusion that the cactus habit arose as a specialization in response to dry conditions. But did it !

A desert vegetation consists of plants of mixed taxonomic affinities which, for one reason or another, are enabled to live together in an environment that is unfavourable to plant life in general. It would appear, however, that the various structural modification that enable these plants to co-exist are basically hereditary, and they represent variations of which the limits are controlled by the hereditary potential of the plants in which they are exemplified. Such characters as succulence, and reduction of leaf area are common to desert plants of different affinities, but the succulence and reduction of leaf area are achieved in different ways depending on the affinities of the plants concerned. Convergent evolution sometimes produces plants that look very much alike in spite of their belonging to quite unrelated families, but nevertheless the basic hereditary structure is so strongly imprinted that it is seldom possible for an anatomist to be completely misled concerning the family relationships of the plants concerned. Thus although certain Euphorbiaceae resemble members of the Cactaceae in habit, their microscopical characters include some that are peculiar to the respective families to which they belong. Similarly succulent members of the Compositae (*Kleinia*), Geraniaceae (*Pelargonium*) and Vitaceae (*Vitis* spp.) show that their common character of succulence is superimposed on, or represent a modification of, the basic structure of each of these genera. Some 25 years ago Chodat and Vischer (5) found an interesting range of structure in a number of species of *Eryngium* (Umbelliferae) from Paraguay. Some looked superficially as if they were Monocotyledons rather than members of the Umbelliferae. In some species the structure was xeromorphic, in others hygrophytic, and in a third category there was a mixture of characters of both kinds. Nevertheless, in all species the structure was basically ' umbelliferous'. Similarly Friedel and Yen (7) have drawn attention to the superficial similarity between *Eryngium campestre* L. (Umbelliferae) on the one hand and *Drypis spinosa* (Caryophyllaceae) on the other. Fridel and Yen showed, however, that in spite of their superficial similarity, both species are anatomically similar to the family to which each belongs, thus demonstrating that at least some of the funda-

mental hereditary anatomical characters are not profoundly modified by the environment.

It has already been mentioned that succulence is often looked upon as a specialization that has arisen in response to dry conditions, or a halophytic habitat. The small succulent species *Rhopalota aphylla* N. E. Brown belonging to the Crassulaceae, is of considerable interest in this connection. The species, which has been figured and described by Brown (3), is a leafless, branched, succulent, about 2·5 cm. tall. It occurs in S. Africa at a height of 6,500 feet, at the summit of the Tafelberg in the Clanwillian District. Here it is to be found in rock pools, where it is immersed under 9 inches of water. When cultivated at Kew, it was grown in pots of sand standing in shallow pans of water. The occurrence of this small succulent, not only in a marshy situation, but actually immersed in water, would appear to indicate that the succulent habit is hereditary, and that whilst succulent plants mostly exist in dry or halophytic situations they can also exist elsewhere without losing their succulent habit.

(ii) Sporadic intraspecific variation.

In the course of identifying plant organs that include a fair proportion of secondary xylem, the wood anatomist finds by experience that the structure of almost any species varies within certain limits. These variations occur in different parts of an individual tree, and in trees of any one species from different localities. The variations are, however, usually quite small. For example growth rings vary in width, crystals vary in abundance, and there may be minor variations in ray structure. Since the wood structure of closely related species has a similar capacity to vary, it frequently happens that the structure of the wood of one species overlaps with, or is so similar to that of, another, that the species themselves cannot be identified on the basis of wood structure alone. Additional information, such as that which concerns the morphology of the flowers and fruits or the geographical source, is necessary. Occasionally, however, the wood anatomist is confronted with structural variations within a species that are much wider than the normal range for the species in question. Considerable difficulties have sometimes arisen in identifying the wood of quite common and familiar plants for this very reason. For example, samples of sweet chestnut (*Castanea sativa*) have been received for identification at Kew, in which the vessel pattern and width of rays were so abnormal that the identity of the species was not recognized until careful research revealed the occurrence of intermediate types of structure. The vessel pattern in the stump of a sweet chestnut is sometimes different from that in the trunk wood from a higher level in the same tree. It would appear that, in occasional specimens, the wood structure characteristic of stumps extends to a higher level in the tree, and it was material of this kind that led to the difficulty of identification just mentioned.

A similar experience occurred with the root of a tree, when nothing exactly like a sample that was received for identification from a suburban garden in S.E. London was to be found in the Kew reference collection of microscope slides. After a somewhat prolonged investigation it was felt that the most probable explanation was that the roots were those of a

sycamore (*Acer pseudoplatanus*), but with vessels larger and more numerous than, and arranged in a different pattern from, the normal. A subsequent visit to the site confirmed these suggestions, when foliage and fruits from the same tree proved beyond doubt that it was in fact a Sycamore.

Finally, reference may be made to the work at Kew by Dr. Stant, who showed that the structure of the culms of the common reed, *Phragmites communis*, varies in plants from different British localities. These differences consist of variations in the proportion of fibres present, in the thickness of the fibre walls, in the lengths of the individual fibre cells, and in the extent to which intercellular air canals are developed in the outer ground tissue of the culms. Whether these variations are hereditary, or represent local responses to environment has not yet been established. They are, however, great enough to have some bearing on the suitability of the culms for thatching, so the problem is one of some economic importance. These variations show how careful one must be not to assume that every anatomical difference met with in a particular species necessarily calls for the species to be sub-divided into different taxa.

Wrongly placed Genera

From time to time the anatomist encounters examples of genera of which the structure suggests that they have been placed in the wrong families. When this occurs, it frequently happens that reinvestigation by traditional herbarium methods leads to a similar conclusion. These mistakes most frequently arise over a genus that has been assigned to a particular family when inadequate or badly preserved specimens were the only available material. At other times it seems probable that the mistakes arise because correct observations have been wrongly interpreted.

Numerous examples of errors of the type just described have been recorded under " Taxonomic Notes " in " Anatomy of the Dicotyledons " (8). Examples that have come to light since that work was published include the following :—

(i) The genus *Dioncophyllum* was noted as being out of place in the Flacourtiaceae because of its wood structure and anomalous method of secondary thickening. Quite independently, Mr. Airy Shaw, who was then a member of the Kew staff, noted from its exomorphic characters that the plant was out of place in the Flacourtiaceae. Subsequent work by Mr. Shaw, and anatomical work by the present writer, led to the establishment of a new family the Dioncophyllaceae which appears to have no close allies, but bears some slight resemblance to Nepenthaceae and Droseraceae.

(ii) A newly discovered species from the Cameroons, *Medusandra richardsiana*, was so unlike any other known plants that Mr. Brenan of Kew made it the basis of a new family and order the Medusandraceae. Anatomical research undertaken by the present writer at the same time showed the plant to exhibit a combination of diagnostic microscopical characters that is unknown in any other plant. This fully confirmed that the plant must occupy a very isolated taxonomic position. Mr. Brenan subsequently included *Soyauxia* in the same family on morphological grounds, and for this too the present writer found considerable, although not complete, anatomical support.

(iii) Dr. G. Erdtman, when examining the pollen of *Thorelia* Hance (Lythraceae) and of *Kania* Schlechter (Saxifragaceae) concluded that the pollen of both genera was so alike that they must both belong to the same family. He also noted that the pollen was of the myrtaceous type. Having made these observations, Dr. Erdtman invited the present writer's collaboration in studying these genera from the anatomical standpoint. Beyond expressing the view that both genera should be in the same family, Dr. Erdtman gave no indication of what he believed the affinities of the genera to be before the anatomical work was undertaken. The anatomical work was therefore started without any preconceived ideas, and, despite this fact, the same conclusion as Dr. Erdtman's was reached quite independently, for the structure of both genera clearly pointed to their myrtaceous affinities.

Microchemistry

It is well known that chemical products (ergastic substances) are produced during the metabolism of plants. These substances become visible to the microscopist when they are secreted, a process that can occur either in cells that do not appear to have a specialized structure, or in cells, cavities or canals which are primarily secretory structures. The ergastic substances and secretory structures are often of diagnostic value. A little thought will show that, as their occurrence must constitute visible evidence of a fundamental physiological diversity in the plants in which which they occur, it is likely also to provide information of far-reaching taxonomic significance. Examples of secretory structures possessing diagnostic value are the secretory receptacles of the Guttiferae and Rutaceae, and the myrosin cells of the Cruciferae and a few related families. Crystals of calcium oxalate are also of diagnostic value. In some families they rarely, if ever, occur. In Monocotyledons, where calcium oxalate crystals occur, they are generally in the form of raphides, whereas amongst the Dicotyledons, this type of crystal is restricted to not more than about 50 families in some of which they occur sporadically, whilst, in others, e.g. Balsaminaceae, Dilleniaceae and Rubiaceae, they are a characteristic feature. Similarly very small crystals, of which the various types can be classified collectively as crystal-sand, are restricted to some 36 families of Dicotyledons. In most dicotyledonous families the dominant crystals are solitary and clustered (druses) types. It would be most interesting to know what chemical or other physical conditions determine the form of crystals in different plants since this information would give us further insight into comparative biochemistry in relation to taxonomy. The fact that similar crystals are secreted in unrelated families indicates that the conditions for the secretion of a particular type of crystal must have been evolved more than once. Starch grains of different form are similarly of diagnostic value and must reflect differences in heredity. This applies also to the different forms of silica bodies in the Gramineae.

When we come to consider a substance such as latex, using this term in a broad sense to cover the different chemical substances and mixtures that are loosely classified under this name, one cannot help asking oneself why it is that most plants can exist without an elaborate system of laticifers, whilst a restricted number of genera and families cannot. For example

the 2 allied families Apocynaceae and Asclepiadaceae both have latex systems, and are further linked together by the occurrence of intraxylary (perimedullary) phloem in both. The microscopy of ergastic substances and of the structures in which they are secreted thus serves as a connecting link between comparative anatomy on the one hand, and comparative biochemistry on the lines being developed by Professor R. D. Gibbs of McGill University in Canada. Thus the tools to be used in taxonomy can be widened still further.

An outstanding example of correlation between comparative chemistry and systematic anatomy was afforded by an experience of my own which arose in this way. Many of the slides in the reference collection at the Jodrell Laboratory are double stained with iron alum haematoxylin and safranin. With this method of staining, the iron alum reacts with substances that are broadly classified as ' tanniniferous ' to give a characteristic dark blue or almost black colour. A rapid survey of Dicotyledons stained in this way shows the families to fall broadly into groups that do and do not respectively contain ' tanniniferous ' substances. A comparatively few families give intermediate or indeterminate results. The difference is clearly fundamental, hereditary and taxonomic, and plants in which tannins occur do not appear to be confined to any particular type of habitat, although this point might repay further investigation. It should be noted that tannins are much more common in woody plants than in herbs, but even this distinction is not absolute. Although I had been aware of these facts for a number of years, my interest in the subject was quite unexpectedly renewed by some work by Dr. Bate-Smith, Superintendent of the Low Temperature Research Station at Cambridge. Dr. Bate-Smith's investigation was concerned with the occurrence of leuco-anthocyanins in plants. He at first studied the occurrence of these substances in flowers, and noted that leuco-anthocyanins and ' woodiness ' appeared to be correlated chacters. Later on he evolved a technique whereby the presence of leuco-anthocyanins could be detected in leaves, and was thus able to extend his observations to a much wider range of plants. Whilst examining Dr. Bate-Smith-Smith's results, I noted that his tests for leuco-anthocyanins gave positive results with the same genera and species as those in which the iron alum haematoxylin revealed the presence of ' tanniniferous ' substances. Further comparison showed the parallelism between his results and mine to be so close that the similarity must be regarded as highly significant. Looking at the results in more detail it may be noted that of 67 families of which representatives were examined, 39 were highly tanniniferous, 28 contained little or no tannin, and 10 gave mixed or inconclusive results. Of the 39 highly ' tanniniferous ' families all but 2 (Plumbaginaceae and Polygonaceae) consisted of woody plants. Of the 28 families with little or no tannin, 6 were wholly herbaceous, 9 wholly or mainly woody, and 13 consisted of woody and herbaceous plants in various proportions. Of the 10 families that gave mixed or inconclusive results, 3 were wholly woody and 7 consisted of mixed woody and herbaceous plants. The families in each category represent a very mixed assortment from the taxonomic standpoint, and beyond the fact that the capacity to produce tannins and leuco-anthocyanins runs in families, it is not at present possible to assess the full taxonomic implications of the synthesis of these substances. Once more

it looks as if it may be a character that has been evolved several times in the course of angiosperm evolution.

Conclusion

We see that taxonomy is likely to develop to the best advantage by the collaboration of the herbarium botanist with those who approach the subject by laboratory techniques. The laboratory methods referred to in this article are likely to prove valuable chiefly because they point to broad conclusions concerning angiosperm phylogeny and taxonomy ; their value in determining the limits of species, and taxa of lower rank, while not to be despised, seems likely to be less fruitful. The cytological approach to these problems has already proved to be more valuable in interpreting taxa at or below the rank of species. The laboratory approach to taxonomy should lead to a closer integration of systematic with other branches of botany.

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The Dahlia Grower's Treasury.*—Dahlia lovers will welcome this book on their favourite flower by an author who is fully qualified to write about dahlias, having spent many years growing and exhibiting them.

The introduction is followed by an account of the history and evolution of the dahlia, while other chapters provide useful information on propagation, cultivation, exhibiting, storing the tubers, diseases and pests, etc. Selected lists of varieties are also given as well as a monthly operational calendar. Those who read this book carefully and put its contents into practice should make considerable advances in dahlia growing. The book is illustrated by many excellent photographs and line drawings and is provided with a useful index.

H. S. Marshall.

* The Dahlia Grower's Treasury. By A. T. Barnes. London : W. H. & L. Collingridge Ltd. New York : Transatlantic Arts Inc. 1954. Pp. 160 ; price 15/- net.

NOTES ON ASIATIC GRASSES : XVII.

The species Agrostis zenkeri Trin.

N. L. Bor

Agrostis zenkeri appears in the Flora of British India as a doubtful species credited to Steudel, who published a description in the *Synopsis Plantarum Glumacearum* 170 (1854). Steudel, in that work, however, cites Trinius as the author, as indeed he was bound to do, Trinius having published a description of the species in *Mem. Acad. Sci. Petersb.* 6, pt. 2, 363 (1841). As stated, Hooker considered the species to be suspect and merely gave an abbreviated translation of Steudel's Latin description. Steudel, in his turn, has only given a paraphrase of Trinius's description.

At my request, Academician Professor Baranov, in charge of the Herbarium of the Academy of Sciences, Leningrad, very kindly sent the sheet in question from Trinius's herbarium.

On the sheet is a specimen of a grass without a base. A slip in Russian states, " Taken from a cover on which is written in Trinius's handwriting, *Agrostis zenkeri* m." There is another slip which has the details of the parts of the spikelet as drawn by Trinius. A third label has the words, " *Zenker Nilagiri* ".

This, then, is the type specimen of *Agrostis zenkeri* Trin., and it agrees perfectly with Trinius's description, except in one very important respect. Namely, whereas in Trinius's diagnosis he says "rudimento o ", the rhachilla is definitely produced and penicillate in the type. Somehow or other Trinius missed the rhachilla in the long callus hairs which he portrays so faithfully.

In the discussion under *Agrostis royleana* Trin. (see page 455), a reference is made to this species for the following reason. In his description of *Agrostis royleana* Trin., Trinius describes this grass as having a bearded rhachilla, which it has not, and it was suggested, as a possible explanation, that somehow or other a mistake occurred and the two grasses were confused in this one particular. There is no way of finding out if such a mistake occurred, after such a lapse of time, and one must just accept the facts as they are.

These, however, are not the only mysteries surrounding the grass, for the specimen, itself, is identical with specimens of *Deyeuxia abnormis* Hook. f., a species which up to now has only been found in northeast India. If it was actually collected in the Nilgiris, it is strange that it has not been collected again in Madras during the past 130 years.

A description of the grass follows in the hope that some enterprising young Indian botanist will make an effort to solve the mystery of *A. zenkeri* Tri.

Agrostis zenkeri *Trin.* in Mem. Acad. Sci. 6, pt. 2, 363 (1841).

Deyeuxia abnormis Hook f., Flor. Brit. Ind. **7,** 268 (1896).

Agrostis abnormis Munro in Cat. Pl. Griffith, Falconer and Helfer, 57 (1865) nomen nudum.

A. pleiophylla Mez in Fedde, Rep. Sp. Nov. **7,** 301 (1921).

A wiry annual or sometimes a perennial (?). Culms up to 60 cm. tall, erect from the base or trailing, terete, smooth or scaberulous, glabrous, the more robust forms repeatedly branching. *Leaf-blades* linear-acuminate, rounded at the base, up to 11 cm. long, 3–5 mm. broad,

scabrid or scaberulous on both surfaces and on the margins, flat, rather stiff; *sheaths* tight, clasping, markedly striate, minutely scaberulous above, smooth in the lower half, glabrous ; *ligule* membranous, 1–2 mm. long, scabrid on the outer surface.

Inflorescence a panicle up to 32 cm. long, 10 cm. wide, consisting of a straight erect noded axis, at the nodes of which the spikelet-bearing branches are borne ; axis terete, smooth and glabrous, striate ; branches 3–4-nate, bare in the lower half or third, branching and rebranching ternately and carrying long-pedicelled spikelets, scaberulous ; pedicels dilated at the apex, scaberulous. *Spikelets* 2–2·5 mm. long, gaping widely at anthesis. *Lower glume* 2·5(3) mm. long, 0·8 mm. wide, when flattened, 1-nerved, purplish or greenish, keeled, scabrid on the keel : *upper glume* similar but narrower and shorter. *Floret* ♀ ; *lemma* chartaceous, becoming almost coriaceous, 2.5 mm. long, including the callus, 2 mm. wide, prominently 3-nerved, usually as long as or only very slightly shorter than the longest glume, scaberulous, unawned or rarely with a very short awn only 0·5 mm. long, just below the tip ; *palea* about three-quarters the length of the lemma, 2-nerved, 2-keeled with inturned flaps, hyaline ; *rhachilla* produced, very short, penicillate ; hairs from the callus half as long as the lemma ; *stamens* 3 ; *anthers* 0·75–0·8 mm. long ; *styles* 2 ; *stigmas* plumose.

Ind. Or. : Madras State; Nilgiris, *Zenker* (type of *Agrostis zenkeri* Trin.).

Assam ; Suruseem, *Hook. f. and T. Thoms.* 1232 (type of *Deyeuxia abnormis* Hook. f.) Shillong ; 1500 m., 1 Aug. 1886, *C. B. Clarke* 44382A; Assam Deputation Collection 1835 ; *Griffith* 6663 ; Nongkhrem, 10 Oct. 1850 *Hook. f. and T. Thoms.* ; Shillong, 1400 m., 28 Aug. 1943, *N. L. Bor* 17805 ; ibidem 1500 m., 8 Sept. 1943, *N. L. Bor* 17927 ; Manipur, Sirhoi Kashong 2800 m., 27 Jul. 1948, *Kingdon-Ward* 17882.

Sikkim ; Lachoong, 2700 m., 2 Oct. 1849, *Hook. f.*—in meadows ; 14 Oct. 1868, *Kurz* ; Darjeeling, 2100 m., 22 Jun. 1875 *C. B. Clarke* 26742.

Although the specimen upon which this species was based is stated by Trinius to have been collected by Zenker, there are the best of reasons for believing that Zenker did not collect it. One reason is sufficient to substantiate this statement, namely, Zenker never visited India. He was, however, a friend of Trinius' and sent grasses to him, some of which had been collected in the Nilgiris. For example, the genus *Zenkeria* was named after Zenker by Trinius, and was based on a specimen "habitat in Indiae orientalis Nilgiri dictis". This genus was named as Trinius tells us in Linnea **11,** 150 (1837), "in honorem celeberrimi J. C. Zenker, professoris jenensis, meritissimi florae nilagiricae investigatoris, dixit, gramina ibidem lecta examinare jussus".

This gives a clue to the collector, for Zenker did publish a book, "Plantae indicae quas in montibus coimbaturicis caeruleis, Nilagiri sive Neilgherries dictis, collegit Bernhardus Schmid". The two parts were published at Jena in 1835 and 1837. The inescapable conclusion is, therefore, that the grasses which immortalise Zenker's name were actually collected by Bernard Schmid and sent to Zenker and by the latter to Trinius.

Bernard Schmid (1787–1857) was a missionary who had gone to India in 1817. He was forced to take leave, through illness, about 1834 or 1835, and went to Europe to recuperate. He must then have taken with him the plants which he gave to Zenker and which Zenker described in 1835 and 1837. Presumably he handed over the grasses at the same time.

SOME NEW SPECIES OF SCROPHULARIACEAE FROM EASTERN ASIA.

P. C. Tsoong

The types of the following new species are in the Herbarium of the Royal Botanic Gardens, Kew, unless otherwise stated.

1. **Scrophularia franchetiana** *Tsoong*, sp. nov. (Sect. **Anastomosantes** Stiefelh., Subsect. **Scordoniae** Stiefelh.)

Species proxima **S. Fargesii** Franch. et **S. divaricatae** Ledebour ab illa foliis ambitu orbicularibus basi omnibus rotundatis subcordatisve, nunquam attenuatis, floribus brunneis nec virescentibus ; ab hac foliis et floribus majoribus satis differt.

Caulis elatus, ad 90 cm. altus, parte inferiore obscure quadrangulare, canaliculatus, parte superiore fere cylindrica, striatus, totus crebre albosetulosus setulis glanduliferis. Folia omnia opposita, magna, petiolata ; petiolis foliorum inferiorum ad 3 cm. longis iis superiorum gradatim abbreviatis circ. 5 mm. longis, totis ut caulis albosetosis ; lamina tenuiter herbacea, ambitu orbicularis vel latissime ovata, basi cordata vel in foliis superioribus rotundata, apice breviter acuminata vel acuta, margine grosse sublobulato- et duplicato-serrata dentibus triangulari-acutissimis, supra pilis albidis accumbentibus conspersis subtus praesertim secus nervos praecipuos albo-setosa, ad 11 cm. longa ac lata. Inflorescentia in cymas laxissimas in axillis foliorum mediorum usque ad apicem posita ; cymis paucifloris longe (3 cm.) pedunculatis ; pedunculis pedicellisque glanduliferis. Calycis lobi subacuti, ovati, apicem versus quasi erosi, c. 3 cm. longi, 2·5 mm. lati ; corolla brunnea 14 mm. longa ; tubo 7·5 mm. lato ; lobis labii superioris ovatis apice rotundatis, manifeste longioribus iis labii inferioris ; stamina inclusa ; staminodium rotundatum, subintegrum, 1·5 mm. latum. Capsulae immaturae apice attentuatae.

Western Szechuan : Chin-ting Shan, alt. 4000 ft. (*E. H. Wilson* 3800, type ; 3–5 ft. ; fl. chocolate brown).

2. **Mazus crassifolius** *Tsoong*, sp. nov. (Subsect. **Dentatae**). **M. nudicaulis** Bonati, nom. in Herb. Paris.

Habitu **P. pulchello** Hemsl. proximus, sed foliis repando-paucidentatis texture crassiore, scapo elatiore apicem versus solum florifero, pedicellis glanduliferis et praecipue labio inferiore brevi superum nunquam valde excedente lobisque omnibus truncato-emarginatis erosodenticulatis longe distat.

Planta scaposa, usque 25 cm. alta. Folia omnia radicalia, textura crasso-subcarnosa, spathulato-obovata, apice rotundata vel obtusa, basi longe in petiolum validum plus minusve alatum 15 mm. circ. longum sensim attenuata, margine repando-dentata vel lobulata, dentibus iterum paucidenticulatis, supra glabra, subtus in nervo primario crispato-hirtella, ceterum glabra, ad 9 cm. longa, 3 cm. lata. Scapus efoliatus, striatus, apicem versus minute glanduloso-pubescens, ceterum glaber ; bracteis lanceolato-linearibus 4 mm. longis, pedicellis ad 1 cm. longis pilis glanduliferis conspersis. Calyx campanulatus, 6 mm. longus, tertia

parte in lobos 5 ovato-acutiusculos fissa ; corollae tubo faucem versus magis ventricoso-expanso circ. 12 mm. longo fauce 6 mm. lato ; labio superiore bilobo 7 mm. longo, 8·5 mm. lato, labio inferiore quam superum paulo longiore trilobo ; stamina inclusa ; stylus c. 12 mm. longus, stigmate labellato.

Szechuan : Mt. Omei (*E. H. Wilson* 5044, type), June 1904 ; ibidem (*E. Faber* 798).

Western China : (*E. H. Wilson* 4287).

3. **Mazus henryi** *Tsoong*, sp. nov. (Subsect. **Longipedes**).

M. surculosi Don affinis videtur, sed indumento, folii ambitu, structura floris certe bene differt.

Stolonifera ; radix fibrosa ; stolones elongati, nodis 7–10 cm. distantibus ; caulis brevis, parte juniore dense lanatus. Folia radicalia et caulina omnia longe petiolata ; petiolis 0·8–5 cm. longis, apice sub lamina decurrentibus attenuato-alatis, initio dense lanato-pubescentibus deinde glabrescentibus ; lamina elliptica usque late ovata, apice rotundata usque subacuta, basi late cuneata, margine crenato-dentata dentibus circ. 10-paribus, nunc elobulata nunc ad basin lobulis distinctis 1–2-paribus munita, illa ad nodos stolonis late ovata saepius latiora quam longa, non lobata, utrinque pilis albidis strictis adpressis induta, siccitate discoloria supra plus minus nigrescentia intense viridia, subtus pallescentia, ad 5 cm. longa, 2·5 cm. lata. Flores 2–3 in axillis foliorum superiorum siti, 15–23 mm. pedicellati, pedicellis sparse pubescentibus ; calyx 5 mm. longus late campanulatis ; sepalis late ovatis breviter cuspidato-acutis ; corolla 15 mm. circ. longa ; tubo circ. 8 mm. longo ; labio supero 5·5 mm. circ. longo, apice lobis duobus brevibus lanceolatis 1·5 mm. longis 0·5 mm. latis praedito, labio infero 7 mm. longo, circ. 9 mm. lato, lobo medio oblongo, 3 mm. longo, 2 mm. lato, lobis lateralibus brevioribus sed latioribus ; stamina prope dimidium tubi inserta, filamentis glabris ; stylus circ. 10 mm. longus.

Yunnan : Szemao, east mt., forest, 5000 ft. (*Henry* 11620, type :— purple flowers). Same loc. (*Henry* 12949).

Mazus Henryi, var. **elatior** *Tsoong*, var. nov.

Caule elatiore ad 25 cm. alto, foliis 3–4-paribus, longius petiolatis, petiolis ad 6 cm. longis ; racemis nonnumquam elongatis floribus numerosioribus (13) quam in typo.

Yunnan : Szemao, 4000 ft. (Henry 12906, var. type).

4. **Mazus angusticalyx** *Tsoong*, sp. nov. (Subsect. **Stachydifolii**).

Species distinctissima, caule magis lignoso ramos radicantes profuse emittente floribusque parvis ad **M. procumbentem** Hemsl. accedit sed structura floris ambituque foliorum primo aspectu distinguenda. **M. stachydifolius** Maxim. cujus flos ei speciei nostrae plus minus similis, habitu erecto ramis neque radicantibus foliis elongatis et floribus etiam multo majoribus satis differt.

Herba annua ; radix fibrosa, tenuis ; caulis satis lignosus, hinc inde ramosus, ramis procumbentibus ad nodos radicantibus cylindricis

parte vetustiore sparse parte juniore densius albo-pubescentibus. Folia basalia evanida, caulina opposita vel alterna, lamina rotundato-obovata in petiolum 7–13, raro ad 25 mm. longum cuneato-attentuata, margine grosse paucidentata apice obtusissima vel vix acuta, supra consperse subtus praecipue ad nervos venasque pilis brevibus vestita, usque 35 mm. longa et 20 mm. lata. Flores 10–15, inferiores axillares, superiores in racemos tenues flexuosos dispositi ; bracteis subulatis vix 1·5 mm. longis mox caducis ; pedicelli 3–4 mm. longi ; calycis tubus angustus tempore florendi 2 mm. longus, post anthesin ad 3·5 mm. auctus, prominente parallelo-10-nervatus, nervis pilis sparsis indutis ; corolla parva, circ. 10 mm. longa, tubo calycem vix excedente, labio supero circ. 3 mm. longo ovato-lanceolato apice breviter sed acute bilobo, labio infero quam superum multo majore eumque circ. duplo superante apice trilobo, lobo medio elliptico quam lateralia angustiore plicis 2 prominentibus ; stamina superiora e fauce paulo exserta ; stylus labio supero subaequilongus, stigmate late spathulato-obovato. Capsula inclusa ellipsoidea 3 mm. longa, 2 mm. lata ; seminibus numerosissimis minutis brunneis rugosis.

Shensi : Passage de Wei, alt. 15 -1700 m. (*Licent* 2804, type), Aug. 24, 1916.

5. **Mazus fukienensis,** *Tsoong*, sp. nov. (Subsect. **Stachydifolii**).

Planta **M. japonicae** O. Kuntze similis. Haec species, quamvis habitu speciei nostrae similis, flores majores habet corollae labio inferiore superiorem magis excedente.

Annua ; radix fibrosa ; caules singulares vel plurimi, ramosi, pilis breve obtecti vel fere glabri. Folia spathulato-oblonga, margine antice crenato-dentata, basin versus nunc integra nunc dentibus remotioribus profundioribus simul lobulatis 1 3 paribus instructa ; petioli foliorum radicalium laminam breviores vel nulli. Inflorescentia racemosa, elongata, ad 20 cm. longa ; flores c. 15 ; pedicelli sub anthesi 8 mm. post anthesin 15 mm. longi, minute hispiduli, manifeste alati ; calyx late campanulatus, in flore vix 3·5 mm. in fructu 5 mm. longus, usque ad medium in lobos 5 late ovatos acutos fissus ; corollae tubus brevissimus, vix 3 mm. longus, labio superiore tubo aequilongo in lobos duos oblongo-ovatos vix acutos fisso, labio inferiore multo majore 6 mm. circ. longo, 7 mm. lato, lobo medio late ovato producto quam laterales vix minore ; stamina medio tubo inserta, subexserta ; stylus ad 9 mm. longus.

Fukien : Inghok hsian, Tahshian, by side of stream under hill (*H. H. Chung* 2619, type : Herb 1 5 m., flower purplish blue), April 20, 1924.

6. **Pedicularis fischeri,** *Tsoong*, sp. nov. (Ser. **Tristes**).

Species galea longissima rectiuscula quam tubus sesquilongiore labio angustissimo elongato lobo medio quam lateralia plus duplo majore e speciebus affinis facile separatur.

Cognata ut videtur certe **P. prainianae** Maxim. et **P. clarkei** Hook. f., sed habitu validiore, foliis amplioribus profundius lobatis floribus multo majoribus.

Planta in honorem C. E. C. Fischer qui speciem nostram iam bene adnotaverat, nominata.

Planta elata, ultra metralis, tota crispato-hirsutissima. Caulis simplex, fistulosus, valde striatus basi 12 mm. diametro, parte inferiore nudus, e medio dense foliatus. Folia ambitu anguste lanceolata, ad 11 cm. longa, 28 mm. lata apice acuta, basi sessilia, amplexicaulia, ultra medium in lobos ovato-deltoideos, oblongo-ovatos usque oblongo-lanceolatus 10–13-jugos pinnatipartita, lobis iterum duplicato-inciso-dentatis, pilis multicellulosis supra dense subtus laxius ad nervos tantum obtecta. Inflorescentia elongata, 20 cm. longa ; flores intense rubri, calyx cylindrico-campanulatus, circ. 12 mm. longus, fere ad medium fissus, ad nervos longe pilosus, tubo 8 mm. longo dentibus 5 subaequalibus ; corolla pro serie magna, ad 4 cm. longa, tubo 15 mm. longo adpresse hirsuto, galea rectiuscula leviter cymbiformis, erostrata vel levissime apiculata, circ. 25 mm. longa, dorso pilis longis multicellulosis adpressis densissime obtecta, margine antice parte media barbata, ceterum glabra ; labio ambitu anguste lineari-lanceolato 18 mm. longo, 6 mm. lato, lobis lateralibus lanceolato-ellipticis 2·5 mm. longis vix 1·5 mm. latis, lobo medio elliptico-lanceolato 2·5 mm. lato acutiusculo ; stamina medio tubo affixa, filamentis glaberrimis, antheris ellipticis loculis leviter divergentibus apiculatis ; ovarium ovoideum, 5 mm. longum ; stylus exsertus.

Burma : Valley of Seinghku Wang, 11,000 ft. (*F. Kingdon-Ward* 7209, type. Tall stout plant growing in clumps in open meadows ; fls. dark crimson) July 29, 1926.

7. **Pedicularis flexuosa** *Hook. f.* var. **longituba,** *Tsoong*, var. nov. (Ser. **flexuosae**).

A typo recedit tantum corollae tubo elongato ultra 4 cm. longo.

Nepal : No exact local. (L. Dhevoj 97, var. type in Herb. Edin.), 1928.

8. **Pedicularis domzeyensis,** *Tsoong*, sp. nov. (Ser. **Debiles**).

P. porrectae Wall. accedit, sed planta siccitate nunquam nigrescente, habitu nana, indumento et forma foliorum, etc., satis differt.

Planta nana, vix 7 cm. alta, ramosa. Radix singula, vix incrassata, apice fibrosa, inferne in ramos elongatos divisa. Caules multi, basi bracteis oblongis oblongo-linearibusve obtecti, decumbentes, flexuosi, lignosi, longe pilosi. Folia opposita, radicalia longe, caulina brevius vel vix petiolata ; petiolis ad 1 cm. longis ; lamina in foliis inferioribus oblonga, 9 mm. longa, 6 mm. lata, c. 6-jugatim inciso-pinnatifida vel fere pinnatisecta, illa foliorum superiorum rotundato-ovata vel late triangulari-ovata, latiora quam longa, 7 mm. longa, 10 mm. lata, c. 3-jugatim pinnati-vel subpalmati-lobata, lobis omnibus obtusis iterum inciso-lobulatis dentatisque, margine valde recurvis. Flores oppositi in fasciculos 1–2 distantes dispositi ; calyx cylindricus, dense hirtellus, tubo 4 mm. longo, dentibus 5, oblongis, leviter inaequalibus, margine serratis reflexis ; corollae tubus 7 mm. longus ; labio infero 8 mm. longo, 1 cm. lato, trilobato ; galeae parte erecta 4 mm. longa, parte antherigera 3 mm. longa, apice in rostrum nutans 5·5–6 mm. longum attenuata ; filamentis omnibus glabris.

Nepal : Domzey, 8,000 ft. (*Lal Dhoj* 15, type).

9. **Pedicularis sparsissima,** *Tsoong*, sp. nov. (Ser. **Verticillatae**).

Foliorum ambitu, galeae labiorumque forma, cum **P. lineata** Franch. comparanda, sed planta fere glabra internodiis paucioribus longissimis fasciculis florum tantum 1–3 distantibus non convenit.

Herba annua ; caulis simplex, striatus, pubescens, mox glabrescens, basi squamis paucis ovato-lanceolatis instructus, folia quaternata, elliptica, inferiora 8 mm. superiora 3 mm. longe-petiolata, ad $\frac{1}{3}$ laminae latitudine pinnatifida, 18 mm. longa, 12 mm. lata, basi late cuneata, apice obtusa, utrinque glaberrima, nervis subtus distincte anastomosantibus ; lobis c. 6-jugis, apice subtruncatis denticulatis. Fasciculi florum pauci, 2–3, distantes, pedicellis vix 1 mm. longis ; calyx circ. 4·5 longus, ad nervos parce pilosus, breviter dentatus dentibus vix 1·5 mm. longis ; corolla tubo ad faucem calycis infracto 8 mm. longo ; galea 3 mm. longa, edentata ; labio amplissimo 8 mm. longo 12 mm. lato, lobis 3, fere aequalibus omnibus obovatis apice rotundatis ; stamina contigua filamentis omnibus glabris.

Shensi : Taipaishan (*W. Purdom* s.n., type), 1910.

10. **Pedicularis taquetii** *Tsoong*, sp. nov. (Ser. **Verticillatae**).

Ex affinitate **P. spicatae** Pall. sed habitu, foliis in parte media caulis arcte congestis, corollae labio inferiore multo majore tubo nunquam sub angulo recto vel ultra infracto sed leviter geniculato bene differt.

Herba, basi suffruticosa, erecta vel paulo adscendens, 10–20 cm. alta, valde ramosa, ramis patente adscendentibus, villosissima. Folia 4-natim verticillata, ambitu elliptico-oblonga usque lineari-lanceolata, 10–30 mm. longa, 5–7 mm. lata, arcte pinnatilobata. Spica elongato-capitata, bracteis inferioribus foliis simillimis superioribus rhomboideis subflabelliformibus marginem versus venis pulchre reticulatis dentibusque carnosis reflexis instructis ; calyx anguste campanulatus, 4·5 mm. longus, c. 3 mm. latus, antice obliquus, subfissus ; corolla 16 mm. longa, tubo 11 mm. longo, os calycis versus leviter geniculato ; galea 4 mm. longa, margine antice infra medium cristato-dilatato itaque parte inferiore quam superus 3 mm. latiore ; labio circ. duplo quam galea longiore, latissimo, c. 11 mm. lato, trilobo, lobis lateralibus ellipticis 6·5 mm. longis, 5 mm. latis, lobo medio rotundato-cordato circ. 4·5 mm. longo, 3·5 mm. lato ; antheris contiguis ; filamentis anticis infra antheram pilis paucis sparse ciliatis.

Korea : Quelpaert, in herbosis Hallaisan, 1700 m. (*Taquet* 1168, type), Sept. 1908 ; same local., 1800 m. (*Tacquet* 1170), Sept. 7, 1908.

11. **Pedicularis cephalanthoides** *Tsoong*, sp. nov. (Ser. **Oliganthae** ?).

Species inter **P. Mussotii** Franch. et **P. cephalantham** var. **szetchuanicam** Bonati videtur, ab hac, cuius habitum nostra species simulat, floribus paucioribus galea non cristata, ab illa pedicellis multo brevioribus, ab utraque labii forma propria, quae fere illae **P. pauciflorae** Pennell (**P. megalantha** Don var. **pauciflora** Prain) aemulat facile distinguitur.

Humilis, minus quam 15 cm. alta, undique plus minusve pilosa. Radix simplex, vel nonnunquam ramosa tuberoso-inflata vel fusiformis

fibros paucos longos emittens ; caules singuli vel raro bini. Folia basalia in squamos membranaceos lanceolatos plus minus persistentes redacta, caulina normalia, longe petiolata, petiolis 10–25 mm. longis ; lamina oblonga vel oblongo-lanceolata, pinnatifida vel pinnatisecta, segmentis 6–8-jugis ovatis basi decurrentibus vel attenuatis margine argute serratis. Flores pauci (2–5) in axillis bractearum siti, pedicellati ; pedicellis ad 6 mm. longis ; calyx ventricosus, antice ad mediam partem fissus minute pubescens, 6 mm. longus, dentibus duobus 1·5 mm. longis triangularibus pauciserratis ; corollae tubus 15 mm. longus ; labio amplo 12 mm. longo, 15 mm. lato, ambitu deltoideo ; lobo medio obovato, lateralibus duplo minore, apice distincte emarginato, 5 mm. longo fere ac lato, lobis lateralibus 10 mm. longis, 7 mm. latis, margine antice emarginatis ; galeae parte erecta 4 mm. longa, parte horizontali antherigera fere illam aequante, apice in rostrum c. 5 mm. longum attenuata ; staminum filamenta omnia pilosa ; stylus leviter ex apice rostri exsertus.

Assam : Delei Valley, 28° 21′ N., 96° 37′ E., alt. 11–12,000 ft. on grassy ledges of gneiss and granite cliffs, in open places (*F. Kingdon-Ward* 8379, type.—Flower pinkish purple), June 28, 1928.

12. **Pedicularis lanceifolia** *Tsoong*, sp. nov. (Ser. **Oxycarpae**).

Cum speciebus nonnullis seriei **Oxycarpae** imprimis **P. monbeigiana** Bonati et **P. stenophylla** Li galeae forma maxime convenit, sed planta humilior foliis multo minoribus minusque lobatis, floribus paucioribus etc. cum ea conjugi nequit. **P. insignis** Bonati, habitu a planta nostra haud absimilis videtur, floribus majoribus galea cristata rostroque magis elongato vel circinato statim diagnoscenda.

Perennis ; radix ignota ; collo valido petiolis vetustioribus squamiformibus siccis vestito. Folia fere omnia radicalia, longe petiolata ; petiolis 3 cm. longis, basin versus sensim dilatatis, subtus subglabris, supra canliculatis ubi densissime pilosis ; lamina ad 6·5 cm. longa, 1·5 cm. lata, ambitu lanceolata pinnatifida, subtus ad nervos crispato-pilosa, supra praeter nervum primarium pilosum fere glabra ; lobis 10–14-paribus late ovatis usque lanceolatis lobulato- vel inciso-serratis ; caulis singulus, efoliatus vel unifoliatus, 14 cm. altus, bracteis lanceolatis basi dilatatis antice pinnatifidis. Flores in racemos 8 cm. longos laxe dispositi ; calyx antice ad dimidium fissus, densissime crispato-pilosus, circ. 1 cm. longus, apice 4- vel 5-dentatus, dente posteriore minuto triangulari vix ¼ mm. longo, lateralibus majoribus 1–1·5 mm. longis inciso-paucidentatis ; corollae tubus 13 mm. longus, glaber, labio 9·5 mm. longo, 12 mm. lato, trilobo lobis semiaequalibus lobo medio cucullato ; galea sub angulo recto inflexa parte antherigera 5 mm. longa apice in rostrum 3–4 mm. longum abeunte ; stamina in medio tubo inserta, filamentis omnibus, sed anticis densius quam posterioribus, pilosis.

Frontier of Tibet and Burma : Valley of the Seinghku, in pasture and meadows, alt. 11,000 ft. (*F. Kingdon-Ward* 7218, type), July 29, 1926.

13. **Pedicularis tenuicalyx** *Tsoong*, sp. nov. (Ser. **Abrotanifoliae**).

Forsitan **P. abrotanifoliae** Schrenk affinis, sed jam bracteis profunde palmatilobis pedicellis membranaceo-alatis calyceque post anthesin valde

aucto tenuissimo hyalino satis distincta. **P. tatarinowii** Maxim. cum nostra calyce convenire videtur, galea longe rostrata primo intuitu distinguenda. **P. ponticam** Boiss. e figura Maximowiczii planta nostra appropinquat quoad corollae formam, e diagnosi habitu nana foliis bipinnatipartitis abhorret.

Elata, ultra 25 cm. alta ; caulis simplex, superne longe quadrifariam patente pubescens, inferne fere glabrescens. Folia glaberrima, radicalia 4 cm. longa, petiolata, lineari-lanceolata, c. 4·5 cm. longa, 10 mm. lata, pinnatisecta, segmentis c. 10-jugis distantibus late ovatis interdumque lobulatis incisisque dentatis ; caulina ima opposita, cetera quaterna, omnia plus minus petiolata, lamina lanceolato-oblonga pinnatifida, lobis ovato-lanceolatis circ. 7-jugis argute serratis usque lobulatis. Inflorescentia in verticillis interruptis ; bracteis rhombeo-ovatis, basi membranaceo-dilatatis, lamina digitato- 4–5-lobatis lobis lineari-lanceolatis duplicato-serratis. Calyx 6 mm. longus, post anthesin valde auctus, 10 mm. longus, tenuis, membranaceus nervis validis 10 ; dentibus 5 ; corolla circ. 18 mm. longa, tubo ad faucem calycis incurvo deinde erecto c. 9 mm. longo ; galea 8 mm. longa, edentata ; labio patente 7 mm. longo ac lato, trilobo ; lobo medio rotundato quam lateralia paulo minore ; stamina contigua, filamentis anticis leviter barbatis.

Sinkiang : Koksu Valley, Tienshan, 83° E. and 43° N. (*G. R. Littledale* s.n., type), Aug. 15–Oct. 15, 19 .

14. **Pedicularis forrestiana** *Bonati* subsp. **flabellifera** *Tsoong*, subsp. nov. (Ser. **Paucifoliatae**).

A typo recedit habitu elatiore, racemis valde elongatis ad 20 cm. longis floribus laxe dispositis bracteisque longe petiolatis flabelliformibus.

Yunnan : Kari Pass, Mekong-Yangtze Divide, open situation, amongst heavy grass and scrub (*G, Forrest* 13130, type in Herb. Edin.).

15. **Pedicularis pseudo-heydei** *Tsoong*, sp. nov. (**Paucifoliatae**).

Species prope **P. yunnanensem** Franch. et maxime eius subsp. **praeruptorum** (Bonti), m. (**P. praeruptorum** Bonati ; **P. aphyllocaulis** —.-M.) collocanda est, a qua foliis angustioribus lobisque numerosioribus (in subsp. **praeruptorum** non ultra 13 paribus) margine valde revolutis subtusque dense hispidulis, floribus multo majoribus labio vix ciliato et praecipue galea manifeste cristata auriculataque facile diagnoscenda.

Vix 8 cm. alta, radicibus plurimis carnosis cylindricis vel nonnunquam fusiformibus. Caulis simplex, nudus, pubescens. Folia omnia radicalia, longe petiolata, petiolis dilatatis membranaceis circ. 2 cm. longis glabris ; Inflorescentia subcapitata floribus c. 7 dense congestis ; bracteis lanceolatis basi dilatatis integris pilis albidis longis dense ciliatis. Calyx sub-5-dentatus, tubo antice ad medium fisso superne leviter reticulato ; corolla rubra, tubo 13 mm. longo, leviter pubescente ; galea rostrata, parte erecta margine antice auriculis duobus parvis ornata, brevia c. 4 mm. longa, 2 mm. lata, partem antherigeram versus subito dilatata 4 mm. lata rectangulo-curvata, parte horizontali 8 mm. longa, fronte crista parva sed satis prominente munita, rostro tenui 5·5 mm. longo ac lato, leviter dilatato integro ; labio infero amplo 12 mm. longo, 18 mm.

lato lobo medio rotundato 8 mm. longo ac lato, leviter emarginato lobis lateralibus paulo majoribus rhombeo-ellipticis margine erosis ; stamina ad medium tubi inserta filamentis omnibus, anticis densius, posticis laxius vel vix pilosis ; stylus ex apice rostri breviter exsertus.

Burma : Seinghku Wang, 28° 8′ N., 97° 24′ E., alt. 12,000 ft., on grassy ledges of limestone cliff, embedded with other species of Pedicularis in mats of dwarf salix (*F. Kingdon-Ward* 7093, type), July 10, 1926.

16. **Pedicularis cooperi**, *Tsoong*, sp. nov. (Ser. **Albiflorae**).

Species habitu **P. albiflorae** Prain simillima et certe ei affinis, sed radicibus filiformibus nunquam incrassatis, pinnis foliorum radicalium paucioribus, calycis dentibus longioribus, galea margine antice dentigera rostroque tenui longiore apice haud dentato facile distinguenda. **P. odontophora** Prain, cuius galea dentibus eodem modo obsita, habitu foliique magis abhorret.

Humilis, dense caespitosa, radicibus caespitosis filiformibus non carnosis. Caules plurimi brevissimi 5-20 mm. longi, fere glabri, basi squamis ovatis usque lanceolatis praediti. Folia radicalia numerosa densa, petiolis filiformibus glabris 6–13 mm. longis ; lamina oblonga 4–6 mm. longa, 2·5 mm. lata. Flores pauci, saepe fasciculati ; bracteis foliiformibus saepe oppositis ambitu ovatis vel rotundatis ad 6 mm. longe petiolatis irregulariter inciso-lobatis, margine reflexis ; pedicelli breves, glabri ; calyx anguste cylindricus, glaber, tubo 3 mm. longo dentibus 5, corollae tubus 17 mm. longus, glaber, labio 11 mm. longo, 13 mm. lato, lobo medio quam lateralibus paulo minore ovato-subacuto ; galea parte erecta 5 mm. longa, margine antice apicem versus dentibus duobus parvis sed prominentibus ornata, parte antherigera horizontali 4 mm. longa, 2 mm. lata, apice in rostrum 5 mm. longum subabrupte angustata ; stamina ad 2/5 tubi inferiori inserta, filamentis fere glabris.

Sikkim : below Chola Pass (*R. E. Cooper* 884, type in Herb. Edin.) Sept. 16, 1913.

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THE GENUS ULDINIA J. M. BLACK.

Nancy T. Burbidge, Division of Plant Industry, C.S.I.R.O., Canberra, Australia.

In Acta Bot. Bohem. **1,** 41 (1922) Domin described an Umbelliferous plant under a new name *Maidenia* with the species *M. acroptera* and included with it, almost as an afterthought, *M. ceratocarpa* based on *Hydrocotyle ceratocarpa* Fitzgerald in Jour. W. Austral. Nat. Hist. Soc. **1,** 22 (1904). As he had not seen any of Fitzgerald's material he hesitated to combine the two species though he admitted their close affinity. However, Domin's generic name, whose description was repeated without significant change in Bibl. Bot. **89,** 1043 (1928), is illegitimate being a later homonym of *Maidenia* Rendle in Jour. Bot. **54,** 316 (1916) and it is necessary to find a correct name.

There being no material at Kew of either *M. acroptera* or *M. ceratocarpa* a duplicate of the isotype of the former, which was collected by Boorman, has been made available by Mr. R. H. Anderson, Director of the National Herbarium of New South Wales. This specimen proved to be conspecific with one of *Uldinia mercuralis* J. M. Black in Trans. Roy. Soc. S. Austral. **46,** 567 (1922) collected by Cleland in the type locality. There seems to be no reason why *Uldinia* should not be regarded as the correct name for Domin's genus.

The close similarity between the descriptions of *Maidenia acroptera* and of *Uldinia mercuralis* is not greater than that between either of them and Fitzgerald's circumscription of *Hydrocotyle ceratocarpa.* The few points on which there is divergence do not seem to be of major importance. In the specimens referred to above, the bases of the stipules are fimbriate-ciliate along the margins and in some cases a few of the lower (but not necessarily the lowest) cilia are joined at their bases. These could have been described as stipules by Domin and Fitzgerald though Black's wording seems more accurate. Domin describes the bracts of the involucre as 1·5 mm. long but they are longer in the duplicate of the isotype and in keeping with Black's " circiter 3 mm. " or Fitzgerald's " nearly as long as the flowers ", i.e., " nearly one line " to which should be added the short pedicel. Black describes the carpophore as " setaceous and adnate to the slightly grooved face of the narrow commissure of one of the two mericarps. It is fragile at the base and falls off with the mericarp to which it is attached." Domin found no carpophore but Fitzgerald states that it is persistent. In Boorman's specimen (the Ooldea specimen being rather young) there are short scarious remnants of the carpophores attached to the pedicels. These, which could be taken for damaged carpophores leading to them being described as persistent, are too fragile to persist long so that it is possible Domin either recognised them as mere vestiges or they were absent from his material. It has unfortunately been impossible to trace Fitzgerald's type but since his description matches the characters to be observed in both the Boorman specimen of *Maidenia acroptera* Domin and that of *Uldinia mercuralis* J. M. Black from Ooldea there seems no doubt that only one taxon is involved. The synonymy may be given as follows :

Uldinia J. M. Black in Trans. Roy. Soc. S. Austral. **46,** 568 (1922). *Maidenia* Domin in Act. Bot. Bohem. **1,** 41 (1922) non Rendle (1916).

Type species : *U. mercuralis* J. M. Black l.c.

Uldinia ceratocarpa (W. V. Fitzg.) comb. nov. ; *Maidenia ceratocarpa* (W. V. Fitzg.) Domin in Act. Bot. Bohem. **1,** 42 (1922) ; *Hydrocotyle ceratocarpa* W. V. Fitzgerald in Jour. W. Austral. Nat. Hist. Soc. **1,** 22 (1904) ; *Uldinia mercuralis* J. M. Black in Trans. Roy. Soc. S. Austral. **46,** 569 (1922) ; *Maidenia acroptera* Domin l.c.

Holotype : Wurarga, Sept. 1903, *W. V. Fitzgerald.*

Other specimens : Arrara-Lake Eliza, Oct. 1912, *J. L. Boorman* ; Ooldea, August, *J. B. Cleland* ; about 300 miles N.W. of Woomera, 2.X.1953, *F. L. Hill* no. 169.

The type locality, Wurarga, lies between Mullewa and Yalgoo in Western Australia ; Ooldea is on the eastern margin of the Nullarbor Desert in South Australia and Boorman's locality is in western New South Wales.

Plants, Man and Life.*—Although crop plants and weeds are constantly encountered in everyday life the academic botanist tends to pass them by, so that their nature and origins are often less well known than those of many a rarely-seen wild plant. Dr. Anderson has done much work relating to the history of cultivated plants and weeds and this book is a popular account of some of his investigations, the methods employed, conclusions drawn and the far-reaching possibilities of the study. Subjects discussed include—the effect man has on his environment ; the spread of weeds ; the light thrown by cytology on the problems of plant origins ; the attitude of primitive peoples to plants ; and the beginnings of agriculture. Wheat, maize, sunflower, tomato and cotton are treated in detail as examples. A list of some of the more important economic plants and their origins is given, but the many uncertainties admitted show the need for continued research along these lines. It is stressed that this is not an easy task since such a study necessarily transcends the normal boundaries of such clear set faculties as botany, agriculture, anthropology and archaeology.

While not departing from strict accuracy, the author manages to record scientific observations and deductions in a form intelligible to the layman and has produced an interesting and readable introduction to the subject of the inter-relations of plants and man.

BARBARA J. YOUNGMAN.

* 'Plants, Man and Life. Edgar Anderson. pp. 208, illus. index. Andrew Melrose, Ltd., London, 1953. 15/-).

NOTES ON ASIATIC GRASSES : XVIII.
Indian species of Agrostis collected by Royle

N. L. Bor

During the progress of a study on the species of the genus *Agrostis* found in India, it became necessary to examine the type specimens of those species, which were described by the celebrated botanist Trinius over 100 years ago. His specimens are preserved in the herbarium of the Russian Academy of Sciences at Leningrad, and through the kindness of the Director, the type specimens were made available for study. A request was made for the following types : *Agrostis pilosula* Trin., *A. royleana* Trin., *A. nervosa* Nees ex Trin. and *A. ciliata* Trin. The types of all the species except the last named, which could not be found, were sent to Kew. The examination of these types has revealed a state of confusion in the interpretation of certain species found in India, which it is the purpose of this paper to clear up.

The four species were based on specimens which had been collected by Royle in the northwest Himalaya about 120 years ago. The German botanist, Nees von Esenbeck, had named the species in manuscript, but never published any description of his new species. Trinius certainly saw the specimens named by Nees and he drew up proper descriptions of the new species which he published in the Memoirs of the Academy of Sciences, St. Petersburg, sér. 6, **6** (1841).

Trinius in these descriptions refers to the manuscript names of Nees, and on his own type sheets to the numbers on Royle's specimens. Unfortunately the set of Royle's specimens at Kew does not bear any numbers, and therefore until the types were seen it was difficult to say what particular specimens Trinius was working on. It is not suprising, therefore, that in the Flora of British India, Trinius' species were completely misunderstood.

Recently, however, Royle's own herbarium has come to light and is now in the Liverpool Public Museum. It was acquired by the Museum as a gift from the Liverpool Pharmacists' Association, to which it had been donated by Royle, presumably when he was Professor of Materia Medica at King's College, London. The grasses from Royle's herbarium were sent on loan to Kew through the courtesy of Mr. Stansfield of the Botany Department, City Museums, Liverpool.

The value of the herbarium now at Liverpool lies in the fact that the specimens are numbered and some are roughly localised. As was to be expected, there are mixtures in some of the folders, sometimes of different species, and in at least one gathering, of different genera. The names of the species are in the hand of Nees von Esenbeck. In no instance has a label been written by Trinius, so it is likely that Trinius saw the set which was named by Nees, but this does not entirely rule out the possibility of Trinius having seen Royle's own specimens. There are, however, no references to Trinius in the letters from Royle to Hooker preserved at Kew. Despite the fact that Nees' labels are found with the specimens in Royle's herbarium, these labels are not always attached to a particular specimen, so that one cannot be absolutely certain that they do correspond to one another. This is all the more doubtful when a mixture happens to be in a folder.

All these difficulties would have disappeared had Nees' herbarium been available for study. Unfortunately, however, all Nees' types were destroyed when the Berlin herbarium was gutted by fire after an air raid in 1943. We have therefore to make the best use of Trinius' type specimens and the collections of Royle.

In order, therefore, to elucidate Trinius' species, an account will be given of each type sheet and the corresponding specimen or specimens in Royle's herbarium. After which, an examination of the evidence for the retention or reduction of each species will be made. Finally, proposals will be made for the better understanding and classification of the species involved.

Agrostis pilosula *Trin.*

Lachnagrostis scabra *Nees*, a manuscript name given by Nees to a specimen in Royle's herbarium, was transferred to *Agrostis* by Trinius who, being unable to retain the specific epithet " *scabra* " on account of the earlier *Agrostis scabra* Willdenow, called the species *Agrostis pilosula* Trin. Trinius gives a description of the grass in Mem. Acad. Sci. Petersb. sér. 6, **6,** 2, 372 (1841), noting that the base was absent. In the interleaved copy of this work at Kew, Bentham has noted with regard to this species, " I have identified Wall. L3775a with this in Kew Hb. : quoting also as a synonym *A. Wallichiana* Steudel Syn. 174, 143. Steudel describes his plants from 3775a of Wall. Grisebach in Goett. Trans. 1868/81 says ' *A. wallichiana* is a synonym of **A. Roylei*'." In the Flora of British India Hooker says with regard to *Calamagrostis pilosula* that Wallich 3775a may be taken as the type.

The type sheet from Trinius' herbarium in Leningrad is labelled " Typus " and has two labels affixed to it. The first has a drawing of the spikelet, the lemma, palea and an anther. Attached to this label is a branch of an inflorescence, bare at the base, and bearing a number of spikelets which are pale yellowish-green in colour. The dimensions of the spikelets are as follows :—Lower glume 3 mm. long ; upper glume 2·5 mm. long ; lemma 2 mm. long, sparsely hairy, awned in the lower quarter ; palea less than half the length of the lemma ; anther as long as the palea. The other label has the following in Trinius' hand. " *Agrostis pilosula* m. Lachnagrostis scabra N. Ess. in hbio. Royle, Ind. reg. mont. sup. no. 72 ".

In Royle's own herbarium there are three specimens together with the name Lachnagrostis scabra N. ab E. One of these is labelled "Huttoo", another " 187/73 ", and a third " 187/267 ". In Nees' handwriting we find a slip with the words " 187/72 & 73 *Lachnagrostis scabra* Simla, Mussooree, Huttoo ". The specimen referred to as being labelled Huttoo is clearly no. 72 of Royle and is therefore the cotype. The effect of all this is marred by the fact that 187/267 also called *Lachnagrostis scabra* N. ab E. in the latter's handwriting, is not an Agrostis, but a *Poa*, namely, *Poa nemoralis* Linn. The other specimens, however, in the folder are an exact match for the spikelets in Trinius' type and enable the plant to be identified with certainty as what Hooker called *Calamagrostis pilosula* (Trin.) Hook. f. var. *scabra* Hook. f.

*The name *A. roylei* does not seem to have been published by anybody.

Incidentally. Wallich's sheet L 3775a is in the Kew Herbarium and is indeed what Bentham considered it to be, namely, *Agrostis pilosula* Trin.

The word ' contracta ' used by Trinius in his diagnosis to describe the panicle need not be taken too seriously, for later on in the description of the species he mentions that the lower branches are 2–3 inches long. As is well known, the panicle branches spread widely in *Agrostis*, and a spread of six inches would hardly be described as a contracted panicle. At any rate, the specimens upon which A. pilosula was based show an effuse panicle with widely spreading branches.

Agrostis royleana *Trin.*

Agrostis royleana *Trin.* was published by Trinius in Mem. Acad. Sci. Petersb. sér. 6, **6,** 2, 371 (1841). According to him the species was based on *Lachnagrostis royleana* Nees in Royle hb. Ind. reg. mont. sup. no. 266 and on *L. hookeri* Nees. He further cites three gatherings, viz. Royle's from northwest India, Zenker's from the Nilgiris and Whytt's from Ceylon. The description is full and adequate, and mentions inter alia that the rhachilla of the spikelet is prolonged and bearded (rudimentulo barbato). It is quite clear that nobody working on Agrostis, except Trinius, has ever seen the type of *A. royleana.* Certainly Hooker did not see it, for he places it in the doubtful species of *Calamagrostis* [Flor. Brit. Ind. **7,** 265 (1896)] remarking that the feature of the prolonged rhachilla would place it in the genus *Deyeuxia* and that he had never seen a *Deyeuxia* from the Nilgiris or Ceylon. Neither did Steudel see the type of Royle's no. 266, for he repeats Trinius' assertion that the rhachilla is prolonged and bearded [Syn. Pl. Glum. 173 (1854)].

It was, therefore, extremely important that the type of this species should be seen. The sheet from Trinius' herbarium is labelled "Typus", and at the bottom is a slip written in Russian which reads, on translation, " taken from a cover on which in Trinius' handwriting are the words Agrostis royleana m."

This, then, must be the authentic type specimen. It consists of a really artistic brush and wash drawing of a grass with a very congested panicle. In a capsule are portions of two branches bearing spikelets. The drawing also has pen and ink sketches of the spikelets and dissections upon it. At the base of the drawing is written in Trinius' handwriting " 533 Lachnagrostis Royleana N.Ess. in Royle hb. Ind. Reg. mont. sup. no. 266 (Nees Herb.)". One of the spikelets was dissected and the following are the dimensions of the parts of the spikelet ; lower glume 3 mm. long ; upper glume 2·75 mm. long ; lemma 2 mm. long, hairy, awned in the lower quarter ; *palea* 1 mm. long ; anthers 0·8 mm. long ; rhachilla not produced.

How one can reconcile this last statement with Trinius' description, " rudimentulo barbato ", is difficult to say, for not only is no trace of a prolonged rhachilla to be seen in the type specimen but also there is no indication of such a structure in Trinius' sketches of his dissections.

One possible explanation may be found in the citation of Zenker's specimen from the Nilgiris. An *Agrostis* collected by Schmid* in the

*See discussion p. 441 under *Agrostis zenkeri* Trin.

Nilgiris, is the type upon which Trinius founded a new species *A. zenkeri* Trin. and this was sent with the other types to Kew. In it the rhachilla is prolonged and bearded. Could Trinius possibly have confused this species with *A. royleana* ? It may be so, but one cannot be certain. There is no trace of Whytt's specimen from Ceylon, so that we do not know if the rhachilla is prolonged in it or not.

In Royle's herbarium his numbers 266 and 270 are placed together, both having been collected, according to the label, at Kedarkanta, i.e. at an altitude of about 3,600 m. The material consists of five separate panicles of an *Agrostis* which correspond in every way to the sketch in Trinius' herbarium and to the dimensions of the spikelets which accompany the sketch.

Agrostis ciliata *Trin.*

The Director of the Herbarium of the Russian Academy of Sciences, Leningrad, has informed me that the type of *Agrostis ciliata* Trin. is not to be found in Trinius' herbarium. We are therefore left with Trinius' description of this species together with the specimens in Royle's own herbarium.

In Royle's herbarium there are four specimens each labelled *Lachnagrostis ciliata* N. ab E. as follows—

187/67	Lachnagrostis ciliata	N. ab	E.	var. β
187/71	,,	,,	,,	var. α
187/303	,,	,,	,,	
187/350	,,	,,	,,	var. β

There is another label in Munro's (?) handwriting which states, " 71 and 350 are Agrostis ciliata Trin. Lachnagrostis ciliata N. ab E. but 303 is, I think, Agrostis Royleana Trin.".

Now, 187/350 is quite different from the others. In it the palea is nearly as long as the lemma, and the awn is very short, hardly clearing the tips of the glumes. This species is *Agrostis munroana* Aitch. et Hemsl. which Hooker transferred to the genus *Calamagrostis* in the Flora of British India. Numbers 67 and 71 are similar to one another and correspond to small spiculate forms of *Agrostis pilosula* Trin., while no. 303 is a large spiculate form (the var. *ciliata* of Hooker).

The puzzle here is to decide what is meant by *Lachnagrostis ciliata*. In Trinius' description he says of the awn that it hardly exceeds the glumes " arista glumas paullo superante ", which itself would point to *Agrostis munroana*, but he also says the awn is geniculate, which does not agree with the awn in *Agrostis munroana*. Royle's number 350 must therefore be ruled out.

He also mentions the palea which he says is " valvula superior duplo triplove brevior ", which points to Royle's numbers 67, 71 and 303.

Which of the three Trinius had before him can be deduced from the diagnosis at the head of his description of the plant [Mem. Acad. Sci. Petersb. sér. 6, **6,** 2, 373 (1841)], particularly where he says the spikelets are more than 1½ lines long and the lemma is about half the length of the glumes. This points decidedly to specimen no. 303, where the dimensions of the spikelet are as follows : lower glume 4·25 mm. long ;

upper glume 4 mm. long ; lemma 2·25–2·5 mm. long, hairy, awned in lower third ; palea minute ; anthers 1 mm. long ; awn basal, geniculate, protruding.

Incidentally, there is nothing by which this specimen can be separated from Hooker's *Calamagrostis jacquemontii* Hook. f. Indeed, Hooker himself, in the Flora of British India, indicates his doubts about the latter, where (vol. 7, 265) he says, " This approaches var. *ciliata* of *C. pilosula*, but the spikelets are considerably larger ". Actually the spikelets are not as large as Hooker alleges they are and differ very little in size from that of *Agrostis ciliata* Trin.

From the diagnosis of the type spikelets of *A. pilosula*, *A. royleana* and *A. ciliata*, it is quite clear that they have the following essential characteristics in common :—a hairy lemma, awned, with a perfect awn in the lower third or quarter, a palea less than half the length of the lemma, a lower glume which is about one-quarter of a millimetre longer than the upper, and anthers which are about half the length of the lemma. In fact, the spikelets are identical in size in the first two species, while the third, *A. ciliata* has spikelets similar but somewhat larger.

The three Trinian species can now be stated, as is evident from the very large amount of material available, to belong to one polymorphic species in which there is every gradation from the small to the larger spikelets and from the effuse to the congested panicle.

It is, therefore, proposed to consider *A. pilosula* Trin. as the species, with the other two as synonyms, viz., *A. royleana* Trin. and *A. ciliata* Trin. *A. jacquemontii* Hook. f. is so similar to *A. ciliata* Trin. that it also falls within the range of *A. pilosula* Trin. and must be reduced to synonymy.

The description of *Agrostis pilosula* Trin. which follows here takes cognisance of the variability of the plant in the measurement of its parts. The description is followed in turn by a key to the varieties and their distribution.

Agrostis pilosula *Trin.* in Mem. Acad. Sci. Petersb. sér. 6, **6,** 2, 372 (1841).

Calamagrostis pilosula (Trin.) Hook. f., Flor. Brit. Ind. **7,** 263 (1896).

Lachnagrostis scabra Nees ex Trin. loc. cit. 372, nomen nudum.

Agrostis royleana Trin., loc. cit. 371.

Lachnagrostis ciliata Nees ex Trin. loc. cit. 373.

Agrostis ciliata Trin. loc. cit. 373.

A. wallichiana Steud., Syn. Pl. Glum. 174 (1854).

Calamagrostis jacquemontii Hook. f., Flor. Brit. Ind. **7,** 265 (1896).

C. hookeriana Nees ex Steud., loc. cit. 192.

C. roylei Nees ex Steud., loc. cit. 193.

C. neesii Steud., loc. cit. 193.

An annual grass. *Culms* stout or slender, 30–75 cm. tall, smooth and glabrous, terete, unbranched, tufted from a short inclined base. *Leaf-blades* linear-acuminate, flat, up to 30 cm. long, up to 5 mm. wide, minutely scaberulous on both surfaces and on the margins, with a sparse

covering of short, white hairs on the upper surface, or both quite glabrous; *sheaths* long but shorter than the internode, smooth and glabrous, clasping the culm ; *ligule* membranous, 1–2 mm. long.

Inflorescence a panicle, very variable, ranging from very effuse with long branches (var. *scabra*) to dense and interrupted (var. *royleana*). Axis of the panicle terete, smooth and glabrous or minutely scaberulous ; branches usually whorled, 2–5-nate at the lowest nodes, flexuous, in the long-branched panicles bare of spikelets in the lower half, usually trichotomously rebranched. *Spikelets* 2·5–5·5 mm. long, with the lower glume about 0·5 mm. longer than the upper. *Lower glume* 2·7–5·5 mm. long, lanceolate acute in shape, 1-nerved, smooth and glabrous on the sides, scabrid on the keel in the upper half ; *upper glume* about 0·5 mm. shorter, of similar texture and shape. *Lemma* hyaline, from one-half to three-quarters the length of the lower glume, elliptic-truncate in shape, 5-nerved (with 4 lateral often produced as short point at the top, the median nerve carried out as a perfect awn from the lower third or quarter of the dorsal surface), hairy all over the dorsal surface or sometimes almost glabrous but with the hairs obvious on the sides ; *palea* shorter than half the lemma, hyaline, oblong or ovate-obtuse in shape ; *stamens* 3 ; *anthers* 0·75–1·5 mm. long ; *styles* 2 ; *stigmas* pilose.

Key to the varieties of *Agrostis pilosula*

Glumes 4·5–5·5 mm. long, twice as long to more than twice as long as the lemma ; spikelets often purplish . . . *A. pilosula* var. *ciliata*

Glumes at the most 4 mm. long, often much less, at any rate not twice the length of the lemma, anthers 0·8–1·25 mm. long :—

Panicle very effuse ; branches 6–10 cm. long, bare in the lower half ; spikelets greenish or greenish yellow . *A. pilosula* var. *pilosula*

Panicle contracted or moderately spreading ; branches shorter to very short ; spikelets greenish or purplish :—

Panicle more or less dense, interrupted, with short branches 1–2 cm. long . . . . . *A. pilosula* var. *royleana*

Panicle more open ; branches less than 6 cm. long :—

Leaves at the base filiform ; panicle not stiff *A. pilosula* var. *filifolia*

Leaves at the base not filiform, flat ; spikelets purple ; panicle rather stiff . . . . . *A. pilosula* var. *wallichiana*

var. **pilosula.**

Calamagrostis pilosula Hook. f. var. *scabra* Hook. f., Flor. Brit. Ind. **7,** 264 (1896).

Ind. Or. : N.W. India : *Royle* ; Simla, *Madden* ; Kashmir, Basaoli, 26 Sept. 1876, *C. B. Clarke* 31593A ; Simla, 22 Aug. 1889, *J. F. Duthie* 10088 ; Hazara, Siran Valley, 2400 m., 14 Oct. 1937, *R. N. Parker* 3412 ; Simla, Mahasu, 2400 m., Aug.

1878 *J. S. Gamble* 6456E ; Dalhousie, 1800 m., 22 Sept. 1874, *C. B. Clarke* 22977A ; Sikkim : Neebay, 2100 m., 16 Oct. 1875, *C. B. Clarke* 25340A ; Madras : Ootacamund, 2400 m., 22 Mar. 1870, *C. B. Clarke* 11185 ; Swamp, The Downs, Ooty, 25 Sept. 1908 *A. G. Bourne* 5234.

var. **royleana** (*Trin.*) *Bor* stat. nov.

Agrostis royleana Trin. in Mem. Acad. Sci. Petersb. sér. 6, **6,** 372 (1841).

Calamagrostis pilosula Hook. f. var. *alpestris* Hook. f. Flor. Brit. Ind. 264 (1896).

C. hookeriana Nees ex Steud., loc. cit. 192.

C. roylei Nees ex Steud., loc. cit. 193.

Ind. Or. : N. W. India ; *Royle* ; Kashmir, Sangar Valley 3900 m., 12 Aug. 1893, *J. F. Duthie* ; Laka, Dharamsala, 3300 m., 17 Oct. 1874, *C. B. Clarke* 24600 ; Palgam 4020 m., 4 Sept. 1876, *C. B. Clarke* 31070 ; Dalhousie, 2100 m., 23 Sept. 1874 *C. B. Clarke* 22983 ; Hazara, Shadal, 16 Aug. 1899 Mayat ; Kashmir, Astor, Gudhai Valley 3300–3600 m., 22 Jul. 1897, *J. F. Duthie* 12218.

var. **wallichiana** (*Hook. f.*) *Bor* comb. nov.

Calamagrostis pilosula Hook. f. var. *wallichiana* Hook. f., Flor. Brit. Ind. **7,** 264 (1896).

Ind. Or. : Sikkim ; Jongri 3900 m., 15 Oct. 1875 *C. B. Clarke* 26001 ; Sandong, 4800 m., 11 Sept. 1849, *J. D. Hooker* ; Yak La, 4800 m., *C. B. Clarke* 10187 (several of the spikelets of the gathering are 2-flowered, the upper being without an awn) ; Jongri, 3900 m., 10 June 1849, *J. D. Hooker.*

var. **ciliata** (*Nees*) *Bor* stat. nov.

Agrostis ciliata Trin. in Mem. Acad. Sci. Petersb. sér. 6, 6 (1841).

Lachnagrostis ciliata Nees nomen nudum.

Calamagrostis jacquemontii Hook. f. Flor. Brit. Ind. **7,** 268 (1896).

C. ciliata Nees ex Steud., loc. cit. 193.

Ind. Or. : N.W. India ; *Royle* Wingate ; Sikkim ; Karponang 2650 m., 21 July 1945, Dr. Bor's collector ; Punjab, *Jacquemont* 1210.

var. **filifolia** *Bor* var. nov. ab aliis varietatibus foliis basalibus filiformibus recedit.

Ind. Or. : Madras ; Silva Cascade, Riverside Pulneys, 1 Jun. 1898, *A. G. Bourne* 1022 ; Lidcot Valley, Kodaikanal, Pulneys, 10 Jul. 1898, *Bourne* 3143. Bear Shola Valley, Pulneys, 21 Jun. 1901, *Bourne* 1486.

Agrostis nervosa Nees

Agrostis nervosa Nees ex Trin. in Mem. Acad. Sci. Petersb. sér. 6, **6,** 2, 328 (1841). The type specimen from Trinius' herbarium consists of a specimen without a base affixed to a sheet. A slip attached to the

specimen carries the following in Trinius' handwriting—" Agrostis (Trichod) nervosa N. Ess ! Royle hb. (69, 70) Ind. reg. mont. sup. Nees hb." A label pasted on the sheet shows the detailed dissection of the spikelet. The following are the dimensions of the parts of the spikelet: lower glume 2·75–3 mm. long; upper glume 2·5–2·75 mm. long; lemma 1·8–2 mm. long, glabrous, truncate, unawned ; palea very small or absent ; anthers 0·6 mm. long ; ligule 2·5 mm. long.

In Royle's own herbarium there are seven panicles of species of *Agrostis* in the folder of *A. nervosa*. Five panicles correspond to the species found in Trinius' herbarium, one panicle which has awned spikelets and a hairy lemma is what Trinius called *Agrostis pilosula* Trin. The remaining panicle has a label attached with the words *Agrostis alba* Linn. ; it may well be *Agrostis stolonifera* Linn.

Although Nees named this particular grass in Royle's herbarium, he never published a description of the species, and Trinius' specimen which he had before him as he wrote his description must be regarded as the type.

Agrostis nervosa Nees ex Trin. was a puzzle to Hooker, for he mentions this name under the doubtful species of *Agrostis* as well as under *Calamagrostis pilosula* and *Agrostis filipes*. It is very close to *Agrostis canina* Linn. but the acuminate lower glume and small anthers separate them quite readily.

Actually *Agrostis nervosa* Nees is the same as the species called *A. clarkei* by Hook. f. This grass is exceedingly common in Sikkim, but strangely enough, the type comes from the Western Himalaya, and is the only gathering from this area.

A new revision of Lobelia.*—In this volume the author completes his monograph of the subfamily *Lobelioideae* of *Campanulaceae* with an account of the tribe *Lobelieae*. Besides dealing with smaller genera, it provides new revisions of the large tropical American genus *Siphocampylus* (207 species) and of that famous genus of world-wide distribution and horticultural interest, *Lobelia*. The author recognises 365 species of *Lobelia* in his revision, and adds nearly 20 more in his Supplement at the end of the volume. British botanists can tell him that *L. urens* is now known to occur in several English counties besides Devon and Cornwall.

N.Y.S.

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* Das Pflanzenreich : IV. 276 b (107. Heft) : Campanulaceae–Lobelioideae, by F. E. Wimmer. Part II. Akademie-Verlag, Berlin, 1953.

CONTRIBUTIONS TO THE FLORA OF AUSTRALIA: I

A confused Boronia

R. Melville and V. S. Summerhayes

A number of Eastern Australian species of *Boronia* were examined by Cheel (Journ. & Proc. Roy. Soc. N. S. Wales, **58,** 145, 1924 : **61,** 401, 1928 ; **62,** 290, 1929) and as a result many older species reduced to varieties by Bentham are now recognised as distinct species. Owing mainly to the fact that Cheel did not have the type specimens at his command a few points of confusion remain, notably in connection with *B. polygalifolia* Sm.

In 1928 Cheel (loc. cit., 408) resuscitated the long forgotten name *Tetratheca oppositifolia* Pers., Synops. **1,** 419 (1805) for a plant ranging through southern New South Wales, Victoria and Tasmania very similar to *B. polygalifolia* Sm., but differing *inter alia* in the hairy branchlets. Persoon's *Tetratheca* had been transferred to its correct genus by De Candolle (Prodromus, **1,** 722, 1824). On making the transfer, De Candolle, in view of the constant presence of opposite leaves in *Boronia*, changed the trivial name to *tetrathecoides*, in allusion to the resemblance of the plant to a *Tetratheca*. This name is illegitimate. Cheel rightly substituted the combination *Boronia oppositifolia*. In doing so he says (loc. cit. 410, 1928) : " Although I have not seen the original specimens described by Persoon, I have taken up the name ' *oppositifolia* ' as it has nineteen years priority over *tetrathecoides*, and as De Candolle includes it as a synonym we may safely assume that the two names cover the one species." Investigation has shown that Cheel was not justified in his assumption that De Candolle was right in regarding *B. tetrathecoides* as a distinct species or that the plant concerned was hairy.

Tetratheca oppositifolia Pers. was founded on a plant in Thibaud's herbarium collected by Née. Reference to Lasègue (Mus. Bot. Delessert, 451 : 1845) revealed that Née accompanied Malaspina on his voyage round the world, and that the only place visited by him in Australia was Botany Bay, where he landed for a short while sometime between 1789 and 1794. It therefore seemed likely that *Tetratheca oppositifolia* was conspecific with *Boronia polygalifolia* rather than with the hairy southern plant. Consequently, authenticated specimens of each were sent to the Conservatoire Botanique at Geneva where De Candolle's specimens are now housed and at Dr. Briquet's request Dr. Becherer compared them with Persoon's type. In his report Dr. Becherer says that the specimens collected at Port Jackson by R. Brown (no: 5380), which had previously been found to match exactly with Smith's type of *B. polygalifolia* in the Linnean Society Herbarium, " correspond exactly to the plant of the herb. Thibaud " which is labelled " *Tetratheca oppositifolia* ". In addition he states that the hairy species collected by F. Mueller on the Buffalo Range is " not represented under the Candollean plants " of *Boronia tetrathecoides* DC (*Tetratheca oppositifolia* Pers.). All the latter specimens are " completely glabrous ".

Boronia oppositifolia (Pers.) Cheel is therefore a synonym of *B. polygalifolia* Sm., since the new combination must go with Persoon's plant. We are greatly indebted to the late Dr. Briquet and to Dr. Becherer for their help in clearing up this doubtful point.

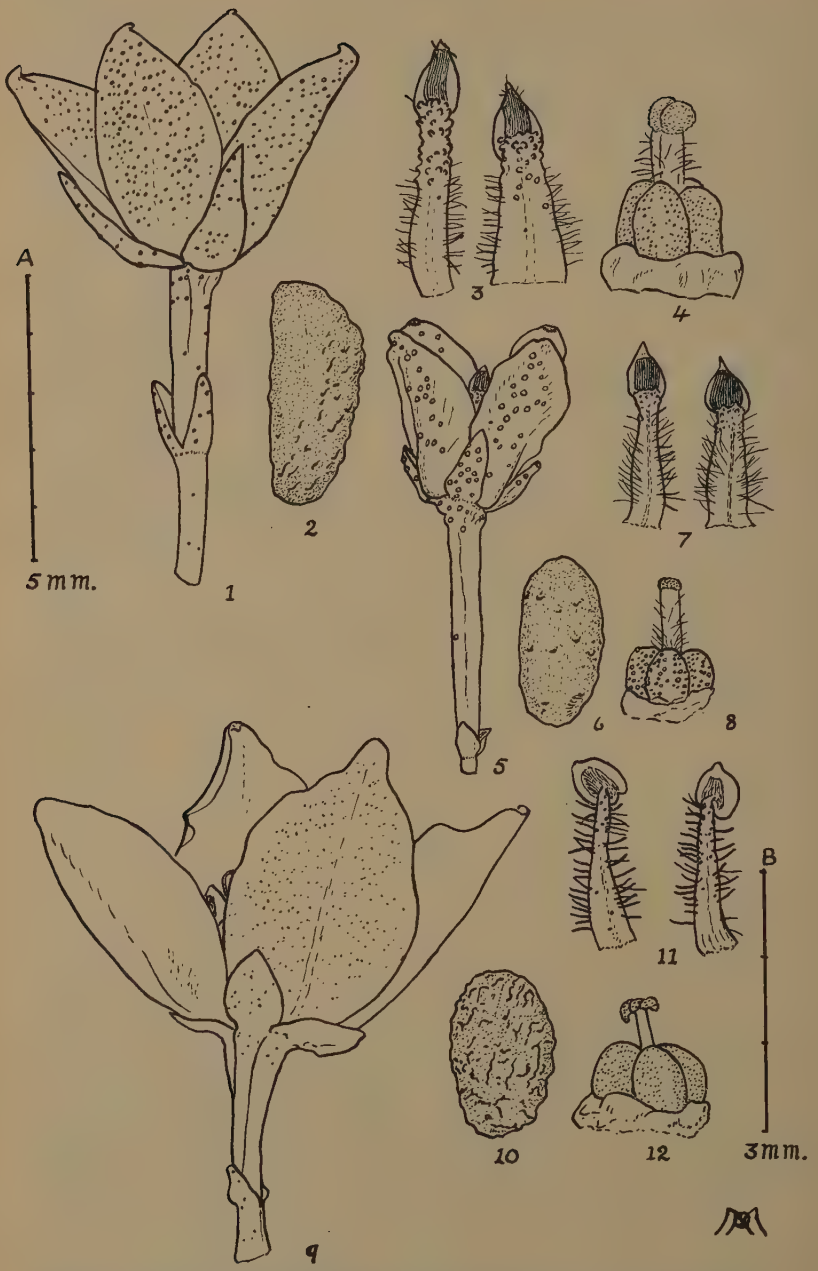

FIG. 1. Entire flower (scale A) and seed, pair of stamens and ovary (scale B) of : (1–4) *Boronia nana* Hook. var. *hyssopifolia* Melville from Melville 3015 (Type) ; (5–8) *B. nana* Hook. var. *nana* from Gunn 894, Rocky Cape, Tasmania (Type) ; (9–12) *B. polygalifolia* Sm. from R. Brown 5380—glands shown on one petal only.

Confusion has existed between the hairy stemmed plant and *B. polygalifolia* Sm. since the time of the early collectors in Tasmania. Hooker took up *B. hyssopifolia* (Journ. Bot. **1,** 255) in 1834 for a plant collected by Lawrence, which cannot now be distinguished in the Herbarium. The name *B. hyssopifolia* Sieber was published as a *nomen nudum* in Flora, Beil. 4, 137 (1825) and cited by Sprengel (Syst. Cur. Post., 148, 1827) as a synonym of *B. polygalifolia* ; however the specimen of Sieber no. 296 in Herb. Kew. is *B. polygalifolia* Sm. In 1836 Hooker (Compt. Bot. Mag. **1,** 277) used the name *B. tetrathecoides*, giving *B. hyssopifolia* Sieb. & Hook. as synonymous. Then in 1840 Hooker fil. (Journ. Bot., **2,** 418) separated *B. tetrathecoides* (Pers.) Hook. fil. from " *B. hyssopifolia* Sieb." Under the latter name he cited Lawrence's specimen of 1831 and Gunn 458 of 1832. There are in Herb. Kew. four gatherings of Gunn No. 458, all of the plant under discussion. These are from different localities, and 1832 is not among the dates recorded. One specimen bears a reference to " Hook. Journ., 2, 418 " but has " R. Gunn 1844 " printed on the label. However, the application of the name *B. hyssopifolia* by Hooker fil. is clear enough.

In the Flora Tasmanica (**1,** 67, 1855) Hooker fil. returned to the old confusion, by using *B. hyssopifolia*, attributed to Sieber, for the hairy Tasmanian plant, but associating it with discordant elements. At the same time he cited Sieber 296 and *B. tetrathecoides* Hook., though showing his doubt of the latter name by adding " an Persoon ? ". He now distinguished two varieties, var. α being the monofoliolate plant and " var. β ; foliis trifoliolatis " being the plant earlier described by Hooker as *B. nana* (Ic. Plant. t. 270, 1840). The occurrence of uni- and trifoliolate leaves together on some plants was mentioned in the discussion, which also stated that the ordinary state of the plant, i.e. the unifoliolate, was sent to him by F. Mueller as *B. tetrathecoides* DC. var. *simplicifolia*. The specimen concerned was collected by Mueller on the Buffalo Range, Victoria in March 1853 and is the one compared by Dr. Becherer with Persoon's type.

Bentham (Fl. Austral., **1,** 321, 1863) included *B. hyssopifolia* Sieb. in his synonymy of *B. polygalifolia* Sm. without comment, although he did include hairy trifoliolate forms under that species. After Cheel had made his invalid combination, " *B. oppositifolia* ", J. M. Black reduced the plant to varietal rank as " *B. polygalifolia* Sm. var. *oppositifolia* (Pers.) J. M. Black ", repeating Cheel's error.

Although the name *B. hyssopifolia* Hook. fil. was validated by a description for the first time in the Flora Tasmanica, it was not legitimately published, because the earlier *B. nana* Hook. was included in the circumscription of the species. Varietal names were not given to either of the two varieties, so that the name *hyssopifolia* was not used in a varietal sense, even by implication and is still available in that rank. Accordingly, the new name given below is proposed and a summary of the synonymy is appended.

Boronia nana *Hook.* var. **hyssopifolia** *Melville*, var. nov. ; a planta typica foliis unifoliolatis, bracteolis saepe medio pedicelli affixis et staminorum filamentis valde glandulis ornatis differt.

[*B. hyssopifolia* non Sieb. ; Hook. in Journ. Bot., **1,** 255 (1834), partim.]

B. tetrathecoides Pers. ex Hook. in Comp. Bot. Mag., **1,** 277 (1836), non DC.

B. hyssopifolia Hook. f. in Hook. Journ. Bot., **2,** 418 (1840), partim, excl. Sieber 296, nomen subnudum.

B. hyssopifolia Hook. f. in Fl. Tasman., **1,** 66 (1855) var. α, non Sieber, nom. illegit.

B. tetrathecoides DC. var. *simplicifolia* F. Muell. ex Hook. f. Fl. Tasman., **1,** 67 (1855), in syn.

[*B. polygalifolia* non Sm. ; Benth. Fl. Austral., **1,** 321 (1863), partim.]

[*B. oppositifolia* (non Pers.) Cheel ; Cheel in Journ. & Proc. Roy. Soc. N.S. Wales, **61,** 408, (1928), excl. pl. Née.]

[*B. polygalifolia* Sm. var. *oppositifolia* (non Pers.) J. M. Black; J. M. Black in Fl. S. Austral., ed. 2, pt. 2, 493 (1948)].

The following specimens are represented in Herb. Kew.

Tasmania : Mt. Direction, 18 ml. N. of Launceston, 6.12.1841, *Gunn* 458/1842 ; Penquite, 10.12.1844, *Gunn* 458 ; Hampshire Hills, *Gunn* 458 ; not localised, *Archer* ; Nietta, *L. V. Lester-Garland*, Nov. 1926 ; between National Park and Westerway, 30.11.1929, *H. F. Comber* 1760 ; 2½ml. E. of Westerway, 11.12.1952, *R. Melville* 2285 ; Hill above Oyster Cove, nr. Hobart, 16.12.1952, *R. Melville* 2413 ; Prosser River Gorge, 4 ml. from Buckland, 18.12.1952, *R. Melville* 2490.

Victoria : Buffalo Range, March 1853, *F. Mueller* ; Blue Range Ck., Nov. 1906, *C. S. Sutton* ; Weelon Ck., Upper Genoa River, Gippsland, 15.1.1953, *R. Melville* 2896B ; Little River, Wulgulmerang, Gippsland, 20.1.1953, *R. Melville* 3015 (Typus).

New South Wales : Sydney, *Clowes* ; Fitzroy Falls, Nowra to Moss Vale Rd., 30.11.1930, *F. A. Rodway* 217.

Additional localities in New South Wales are given by Cheel (loc. cit.) and, on the evidence of J. M. Black's inclusion of it in Fl. S. Austral., the variety ranges into S. Australia.

The variety is typified by a recent collection (*Melville* 3015), duplicates of which will be distributed to Australian herbaria. The plants were growing on a gentle slope above the Little River at Wulgulmerang in open sclerophyll forest with *Eucalyptus macrorhyncha* F. Muell., *Polygala japonica* Hout., *Bossiaea buxifolia* A. Cunn. and grasses. The habit is prostrate to decumbent.

Both the typical form and the unifoliolate variety possess two bands of hairs on opposite sides of the stem in the grooves decurrent from the leaf bases, whereas *B. polygalifolia* has the stems always glabrous. The latter species differs also in its gradually tapering staminal filaments with the ciliation of stouter hairs, the short rounded apiculus of the anther, the glabrous style and more spreading stigmatic lobes, the ovate acute sepals about $\frac{1}{4}$–$\frac{1}{3}$ of the length of the petals and the ellipsoidal, more extensively ridged seeds. In *B. nana* the upper part of the staminal filament is swollen with a glandular decoration so that the slender attachment to the anther is hidden, the apiculus of the anther is triangular acute and frequently bears a few hairs, the style is ciliate, the stigma small and capitate, the sepals lanceolate acute and about half the length of the petals. The

glands on the petals and other floral parts are larger and generally less numerous in *B. nana* than in *B. polygalifolia*. In *B. nana* var. *nana* the bracteoles of single flowers are generally near the base of the peduncles, whereas in var. *hyssopifolia* they are usually near the middle. There is, however, variation and overlapping in this character. The above mentioned characters are illustrated by the drawings (Fig. 1).

Wild Flowers of Western Pennsylvania.*—Three major American institutions have been concerned in the preparation of this sumptuous work which describes and illustrates, in two folio volumes, the wild flowers of Pennsylvania and the Upper Ohio Basin. The first volume contains the text, the second the plates. The area covered by the work includes portions of six states, namely Maryland, New York, Ohio, Pennsylvania, Virginia and West Virginia.

In the introduction to volume 1, Dr. Jennings, who was editor of "The Bryologist" from 1913–37, and author of a *Manual of Mosses of Western Pennsylvania*, relates how the book grew with the help of colleagues and students at the Museum and University of Pittsburgh. He goes on to deal with collectors, authorities and nomenclature, and gives explanatory notes and references. After the author's introduction there is an account of the botany and botanical environment of the region which deals with its history, geology and soils, physiography and topography, climate and plant geography. This is followed by a bibliography, gazetteer, glossary, analytical key to the families and a summary of the plants included in the text. Then comes the descriptive text, the arrangement of which follows Fernald's modification of Engler's system as in the eighth edition of Gray's *Manual of Botany*. Analytical keys for the families, genera, species, and, in some cases for varieties and forms, are provided. About 2,200 species are described and following the descriptions of the species are given the general date of flowering and the distribution illustrated occasionally by a distribution map. These maps show the general range within the region. The genera are numbered throughout the work while the species are again numbered under the genera, and in this connection it would have been an advantage had the genera numbers been printed in heavier type than the species numbers to render them more easily distinguishable one from another.

The second volume contains gravure reproductions of 200 charming water colours depicting 253 plants. The water colours were painted life size by Andrey Avinoff from living plants selected by Dr. Jennings who is responsible for the legends which accompany the plates. It seems a pity that the name of the family was not included in the legends

* Wild flowers of Western Pennsylvania and the Upper Ohio Basin. Text by O. E. Jennings, watercolours by Andrey Avinoff. 2 vols. University of Pittsburgh Press, Pittsburgh, Pennsylvania. Vol. i, pp. lxxv + 574. Vol. ii, xvi + 200 plates. Price $60.

thus saving reference to the text to ascertain this information. There is an error in spelling in the preface to this volume where Baron Rothschild's name is wrongly spelled.

This is indeed an excellent piece of work remarkably well produced and presented in a manner that reflects great credit on all concerned.

H. S. MARSHALL.

The Ferns of New Mexico.*—One would scarcely suspect that the State of New Mexico could support a population of 75 species of ferns and fern allies. Regarded usually as a land of hot dry plains, one is apt to forget that there are also wooded mountains on which bracken may produce extensive stands and the delicate *Cystopteris fragilis* be almost as plentiful. The authors of this book, rather hopefully, have included in their treatment 11 species which, so far, have not been recorded for the State. These species are known to occur in adjacent territories and their presence in New Mexico is strongly suspected.

Of the 64 species whose claims have been verified by herbarium material, *Cheilanthes*, *Notholaena* and *Pellaea* share a total of 19 species. This is hardly surprising as these genera are the successful colonisers of hot dry situations and will undergo a degree of dessication quite surprising in such moisture-loving plants as the ferns.

The authors have adopted a system of classification which corresponds roughly to that of C. Christensen, so far as the true ferns are concerned, but with one extraordinary exception. The Ophioglossaceae are treated as fern allies (sic) together with the Marsiliaceae and Salviniaceae. The two last named, because of their heterospory and peculiar morphology have perhaps a slight claim to separation but the removal of the Ophioglossaceae from the ambit of the Filices is so audacious as to demand explanation. One can only conclude that the authors have been unduly influenced by the hypogaeous gametophyte characteristic of the Ophioglossaceae and perhaps also by the very high chromosome numbers of some of its members. Unfortunately, the authors are peculiarly reticent in this matter and the fern student who has hitherto studied with respect the works of Bower, Campbell, Christensen and Copeland must feel a little perplexed.

A nomenclatural slip which could be remedied in a future edition concerns the names *Botrychium lanceolatum* (Gmel.) Angstr. ssp. *typicum* Claus. (p. 101) and *B. simplex* E. Hitch. var. *typicum* Claus. (p. 102). In accordance with Article 35 of the International Code (1952) the subspecific epithets should repeat the specific epithets without citation of author.

The book, however, in other respects, is a most excellent work of its kind. It contains many line illustrations which are quite adequate for their purpose. There are keys to identification and full descriptions of every species. In particular the type used in printing is bold and pleasant to read.

F. BALLARD.

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* The Ferns and Fern Allies of New Mexico. Howard J. Dittmer, Edward F. Castetter and Ora M. Clark. University of New Mexico Press ; University of New Mexico Publications in Biology, No. 6 (1954). Pp. 139 and figs. 55. Price $1.

NOTES ON THE FLORA OF 'IRAQ WITH KEYS—PART 1.

by R. A. Blakelock

Since the previous publication " The Rustam Herbarium. 'Iraq ", in this journal*, does not by any means include all the species known from 'Iraq, it is felt that a supplementary list should be published.

The Kew Herbarium possesses, as well as most of the older specimens cited by Boissier in his *Flora Orientalis*, more recent collections made by Bornmüller, R. J. D. Graham, Henry Field and Yussef Lazar, F. A. Rogers and various smaller collections. Since the Second World War the Herbarium has been further enriched by those of H. F. Mooney, G. Chapman and J. B. Gillett and A. Rawi. Of the last the first set of duplicates has been presented to Kew and the original collection was deposited at the Department of Agriculture, Baghdad, forming the " National Herbarium, 'Iraq ". The material at the British Museum has also been consulted ; this includes many of Graham's specimens not at Kew and also the collections of C. C. Calder and G. K. Sutherland (see Anthony in Notes R. Bot. Gard. Edinb. **18,** 277–303 (1935)) as well as A. Low's and D. Leatherdale's specimens. Species not represented at Kew from 'Iraq have been listed in various publications on the taxonomic botany of 'Iraq and are included here. These publications are given in the bibliography at the end of " The Rustam Herbarium. 'Iraq " Kew Bull. no. 2, 243–249 (1954).

In order to save space some of the more important publications are referred to below under the author's name only ; thus " Bornmüller p. 98 (1911) " indicates page 98 of his " Iter Persico-turcicum " in Beih. Bot. Centralbl. **28,** abt. 2. 98 (1911). Where any other work of Bornmüller's is meant a reference is given. The works abbreviated in this manner are :

Anthony, J. ; " Plants from Mesopotamia : A Distributional Note " in Notes R. Bot. Gard. Edinb. **18,** 277–303 (1935).

Boissier, E. ; " *Flora orientalis* " **1** (1867), **2** (1872), **3** (1875), **4** (1879), **5** (1884) and Supplement (1888).

Bornmüller, J. : "Iter Persico-turcicum", 1892–3 in Beih. Bot. Centralbl. **28,** abt. 2, 89–171 (1911) ; **57,** abt. B, 247–294 (1937) ; **58,** abt. B, 252–302 (1938) ; **60,** abt. B, 181–228 (1939) ; **61,** abt. B, 72–123 (1941).

Guest, E. ; " Notes on Plants and Plant Products with their colloquial names in 'Iraq ", Dept. of Agric. 'Iraq, Bull. n. 27, 1933.

Handel-Mazetti, H. F. ; " Pteridophyta und Anthophyta aus Mesopotamien und Kurdistan sowie Syrien und Prinkipo " in Ann. K. K. Naturhist. Hofmuseums **26,** 120–154 (1912) ; **27,** 41–92, 391–459 (1913) ; **28,** 14–39 (1914).

Nábělek, Fr. ; " Iter Turcico-persicum " in Publ. Fac. Sci. Univer. Masaryk, nos. 35, 52, 70, 105, 111 (1923, 1925, 1926, 1929, 1929).

Zohary, M. ; " The Flora of 'Iraq and its Phytogeographical Subdivision ", Baghdad, 1950.

*In Kew Bull. no. 3, 375–444 (1948) ; no. 1, 41–65 (1949) ; no. 3, 517–553 (1949) ; no. 3, 441–460 (1950) ; no. 2, 307–229 (1953) ; no. 4, 535–542 (1953) ; no. 2, 241–249 (1954).

Previous workers, except for Boissier, whose *Flora Orientalis*, although still of great use, is now out of date, have published only catalogue lists of the 'Iraq flora, or of collections from that country, without further aid to identification.

In the present paper keys are therefore, provided to *all* the species and genera known from 'Iraq ; the enumeration, however, only gives those which are not mentioned in "The Rustam Herbarium, 'Iraq" or when some additional note is given on the species. The distribution is only given for those species, whose phytogeography has not been dealt with by Zohary. In this way it is hoped that the two series of papers ("The Rustam Herbarium, 'Iraq" and the present publication) taken together will provide a useful, if provisional, flora of 'Iraq.

Ranunculaceae

A. Fruit a group of achenes ; fls. regular

B. Petals conspicuous

C. Petals with a nectary-scale at base

D. Carpels without two hollow tubercles at base . *Ranunculus* L.

DD. Carpels with two hollow tubercles at base *Ceratocephalus* Moench

CC. Petals without a nectary-scale.

E. Stems with several alternate leaves with pinnate linear segments; sepals shorter than petals, coloured but sepaloid; achenes glabrous . . . . . *Adonis* L.

EE. Stem-leaves 3 in one whorl ; sepals and petals all alike petaloid ; achenes hairy . . . . . *Anemone* L.

BB. Petals inconspicuous greenish or absent

F. Leaves all in a basal rosette, linear, entire ; fls. solitary ; petals small greenish ; achenes on a long spike-like receptacle . . . . . *Myosurus* L.

FF. Leaves much divided ; fls. not solitary ; petals absent ; achenes in ± globular cluster . . . *Thalictrum* L.

AA. Fruit a group of follicles (1 follicle only in *Delphinium* spp.)

G. Fls. regular

H. Plant up to 40 cm. high, often less ; perianth yellow no green sepals ; carpels glabrous

I. Stem-leaves a much-lobed involucre just below fl., stem otherwise leafless ; radical lvs. deeply lobed; sepals yellow petal-like, petals form stalked tubular yellow 2-lipped nectaries . *Eranthis* L.

II. Stem-leaves one or several alternate, uppermost some distance below fl. ; all leaves ± orbicular reniform crenate ; sepals yellow, no tubular nectaries . . . . . *Caltha* L.

HH. Plant 45–75 cm. high, radical leaves ternately divided ; 5 green sepals ; carpels hairy
Paeonia L.

GG. Fls. irregular upper sepal forming a long pointed spur at the back of the flower ; fr. 1 or 3–9 follicles
Delphinium L.

AAA. Fruit a capsule ; flowers regular

J. Sepals not petaloid shorter than corolla ; beak of fruit c. 1 mm. long . *Garidella* Tourn.

JJ. Sepals petaloid longer than corolla ; beak of fruit 10 or more mm. long . . . *Nigella* L.

Adonis *L.*

A. Styles shorter than carpels. Flowers 1–2·5 cm. diam.

B. Carpels with a tooth on the upper margin, deeply grooved and with a ring of teeth round the middle

D. Carpels (including style) 4–5 mm. long, tooth acute, towards middle of carpel.

E. Carpels rugose-reticulate on the outer face . *A. aestivalis* L.

EE. Carpels ± smooth on the outer face, posterior part deeply grooved . . . . . *A. microcarpa* DC.

DD. Carpels (including style) 2–3 mm. long, carpels rugose and grooved, tooth on upper margin close to style . *A. dentata* Del.

BB. Carpels without a tooth on the upper margin without a ring of teeth round the middle . . . . . *A. annua* L.

AA. Styles as long as carpels ; no tooth on upper margin, flowers 2–5·5 cm. diam. . . . . *A. aleppica* Boiss.

The key is founded mainly on Huth's revision of *Adonis* [in Sammlung naturwiss. Vorträge **8,** 61–73 (1890)]. It must be admitted that the Oriental populations of *Adonis* are very mixed, and that intermediates exist between the species, as well as considerable variation in flower colour and size within each " species ". *A. cupaniana* Guss., as generally recognized, appears to be intermediate between *A. dentata* and either *A. aestivalis* and *A. microcarpa*. *A. palaestina*, to judge from material so named at Kew, has the flower size of *A. aleppica* and fruit approaching that of *A. aestivalis*.

The material from 'Iraq named as *A. persica* Boiss. in Kew Bull. 377 (1949) is here included under the older name *A. dentata* Del.

Adonis aestivalis *L.*

6 km. above Rawa, Duleim liwa, c. 150 m., irrigated cereal field near river, dry steppe–subdesert climate, copper-coloured with no blotch at centre, 27.3.1947, *Gillett and Rawi* 7012 ; Kursi, Jabal Sinjar, Mosul liwa, 8 900 m., limestone mt. with terraced fig gardens (unirrigated) and

relicts of *Quercus aegilops brantii* forest, scarlet, frequent, 24.5.1948, *Gillett* 11028.

Guest 2005A, *Salim Effendi* 2616 and *Guest* 3280 previously placed in *A. microcarpa* (Kew Bull. 376 (1948)) are perhaps, better regarded as *A. aestivalis*.

A. aleppica *Boiss.*

Serderian near Acra, Mosul liwa, red, 7.5.1948, *Memarian* 10785.

A. annua *L.* (*A. autumnalis* L.).

" Pl. Mesopot., Kurdistan & Mossul ", 1841, *Kotschy* 19.

There is some doubt as to the precise locality of this specimen, but as other specimens have been collected in the adjacent parts of Turkey, it probably does occur in 'Iraq.

Anemone biflora *DC.*

Mts. S.E. of Tuz Khermatu [=Tuz Khurmatli ?], Kirkuk liwa, 250 m., dry steppe, gypaceous hills, plants of moist steppe on N. aspect only, calyx a clear golden yellow sometimes red outside, anthers golden instead of blue-black as in *A. coronaria*, sepals wider blunter, leaf segments wider shorter, locally common seen nowhere else, with *A. coronaria* (all three colour vars.) and seems distinct, no intermediates seen, 20.3.1948, *Gillett and Rawi* 10306.

Distrib. N. 'Iraq, Pers., Afghan., Baluch., Turkestan.

The differences between this species (Bot. Mag. 9551, 1939) and *A. coronaria* are :—*A. biflora*, 2- or 3-flowered, leaflets less dissected with lobes and teeth blunt, first flower well above the involucre on pedicel c. 7 cm. long which is at first much longer than the scape, scape c. 2 cm. when flower opens, pollen white.

A. coronaria, 1-flowered, lobes and teeth of leaflets pointed, flower on short pedicel 1–4 cm. long rarely 7 cm. long, scape long up to 25 cm., pollen black.

Caltha polypetala *Hochst.*

Ser Kurawa, Arbil liwa, 2600 m., by springs igneous or metamorphic rock, in fruit, common, native name pal kundig (K), 11.8.47, *Gillett* 9764.

Is this Oriental species really distinct from *C. palustris* L. ? Hayek (Prod. Fl. pens. Balcan. **1,** 301 (1927)) states that *C. palustris* has 5, rarely 6 perianth segments, while *C. polypetala* has 7–10, but Clapham, Tutin and Warburg (Flora of the British Isles) gives *C. palustris* as having 5–8 segment. Scott Elliot (in B.E.C. Rep. **10,** 872–878 (1935)) gives the number in *C. palustris* in Sweden and Scotland as 4–9, with 5 the commonest, and states that it varies with the general vigour of the individual plant.

Distrib. Bulgaria ?, Cauc., Asia Minor, 'Iraq, Pers.

Delphinium *L.*

A. Carpels one in each flower ; annual.

B. Flowers medium (15–30 mm.), blue ; petals 3-lobed

C. Spur wide at base (3–4 mm.), apex markedly reflexed

CC. Spur narrow at base (1–3 mm.) and tapering apex not markedly reflexed

D. Peduncle ± absent or shorter than capsule . *D. persicum* Boiss.

DD. Peduncle equalling or longer than capsule

E. Spur short (5–12 mm.), hairs on leaf and stem adpressed, lf-segments linear . . . . . *D. tomentosum* Auch.

EE. Spur longer (10–15mm.), hairs spreading subadpressed or absent

F. Divaricate branching, glabrescent or hairy, fls. mauve, leaf segments linear to oblong

G. Glabrescent stems and leaves . . . . *D. oliverianum* DC.

GG. Pubescent, spreading hairs . . . *D. cappadocicum* Boiss.

FF. Branching at a ± acute angle, hairs subadpressed, fls. bright blue, leaf segments linear . . . . . *D. ajacis* L.

BB. Fls. smaller (8–14 mm. long), yellow ; petals obovate, truncate *D. flavum* DC.

AA. Carpels 3–5 in each flower ; annual or perennial.

H. Annuals ; petals glabrous

I. Lateral petals attenuate into claw at base . *D. peregrinum* L.

II. Petals truncate or cordate at base passing abruptly into claw *D. halteratum* S. et S.

HH. Perennials ; lateral petals pilose

J. Flowers yellow . . . . . *D. kurdicum* Boiss. et Hoh.

JJ. Flowers blue, mauve, or violet

K. Spur attenuate, stem ± angular, one bract at base 2 bracteoles towards middle of fl. stalk.

L. Stem somewhat angular, infl. with 40 or more fls. on each branch, fls. violet (dull red purple in sicco) *D. macrostachyum* Boiss. et Huth

LL. Stem angular, infl. with up to 12 fls. on each branch, fls. blue . . . . . *D. micranthum* Boiss. et Hoh.

KK. Spur inflated, stem terete, often one bract and 2 bracteoles at base of flower stalk

M. Fls. very pale mauve, sepals hairy and glabrescent

N. Sepals, stem and leaves pubescent *D. quercetorum* Boiss. et Hausskn.

NN. Sepals, leaves glabrescent . *D.* aff. *saniculifolio* Boiss.

MM. Fls. dark blue, sepals hairy . *D. cyphoplectrum* Boiss.

Delphinium anthoroideum *Boiss.*

"Pl. Mesopot., Kurdistan. and Mossul", 1841 *Kotschy*, No. 351 [381?].

Huth in his monograph of the genus (Engl. Bot. Jahrb. **20,** 366 : 1895) records specimens from between "Tschalaga et Mustaffani prope Dschecireh" 1841 *Kotschy* and "prope Kerkuk" 1867 *Haussknecht.*

Delphinium cyphoplectrum *Boiss.*

Jabal Makhul near Ain Dibs, Mosul liwa, 250 m., dry steppe, steep slopes, leaves variegated, flowers purple blue, frequent, 2.4.47, *Gillet and Rawi* 7223 ; Kifri, Kirkuk liwa, 250 m., gypsaceous hills, dry type steppe, typical of this community, deep purplish blue, frequent, 12.4.47, *Gillet and Rawi* 7404.

This species differs from the Persian and Afghanistan *D. tuberosum* in having adpressed hairy (not glabrous) carpels and the two bracteoles at the base of the flower stalk (not about the middle). *Gillett* 11206 and *Gillett and Rawi* 7404 show the hairy carpels but on the same shoot the bracteoles are attached halfway up the flower-stalk. 11206 has a more flexuose stem and may be identified as *aff. cyphoplectro* Boiss. (Jabal Mahmour between Mahmour and Dibega, Arbil liwa, c. 400 m., limestone steppe, perennial, rich dark blue, frequent, 30.5.1948, *Gillet* 11206).

Handel Mazetti p. 44 (1913) proposed the name *D. schroedingerianum* Hd.-Mazz. for *D. cyphoplectrum* var. *micranthum* Boiss. and cites specimens from near Assur and from Jabal Makhul. Anthony p. 279 (1935) cites a specimen as *D. schroedingerianum* Hand.-Mazz. from Baiji, on the Euphrates about 16 miles N. of Samarra.

D. halteratum *Sibth. et Smith.*

Huth l.c. 480 records a specimen from near the district Gara, Kurdistan collected by Kotschy.

Distrib. (from Huth). S. Eur., Asia Minor, Pal., Syria, N. 'Iraq, N. Afr., Madeira.

D. macrostachyum *Boiss.*

Seed from near Rowanduz, N. 'Iraq, cult. R.H.S. Gardens Wisley, ref. no. 159/46 flowered July 1950, *C. Stansfield Hitchen.*

E. Huth in his "Monographie der Gattung Delphinium" (in Engl. Bot. Jahrb. **20,** 441 : 1895) cites a specimen from Pir Omar Gudrun collected by Haussknecht. Bornmüller p. 98 (1911) cites a specimen from Handren near Rowanduz.

D. persicum *Boiss.*

Inter Erbil [Arbil] et Kirkuk, Assyria, 1868, *Haussknecht* ; no precise locality, 30.5.1934, *H. Field and Y. Lazar* 532 ; Jabal Mahmour on road Dibega-Mahmour, Arbil liwa, 400 m., limestone, steppe, cream then pale purple, common, 30.5.48, *Gillett* 11207.

Distrib. Cauc., Asia Minor, 'Iraq, Pers., Turkestan.

Boissier p. 76 (1867) describes a var. *assyriacum* as "glabrescens, laciniae fol. longiores basi attenuatae" and cites a specimen from near Mosul (*Noë* 148).

Field and Yussef Lazar 532 was at one time erroneously named as *D. rigidum* DC. Field (in Field Mus. Nat. Hist. Anthrop. Ser. 30, 173 (1940)) records *D. rigidum* DC. under nos. 52 and 371 from 'Iraq. These two specimens I have not seen, but they may also be wrongly named and *D. rigidum* has not, therefore, been included in the list of 'Iraqi plants.

D. quercetorum *Boiss. et Hausskn.*

" In quercet. Pir Omar Gudrun, Kurdistan ", 1200–1500 m. 1867, *C. Haussknecht* (syntype).

D. aff. **saniculifolio** *Boiss.*

Jabal Avroman above Darimar-Biyara, Sulaimaniya liwa, 1800 m., limestone mountain, *Quercus aegilops* forest, steep slopes, very pale purple, or grey almost white with darker veins and green tips to sepals, occasional, 7.6.48, *Gillett* 11782 ; Penjwin, Sulaimaniya liwa, 1700 m., whitish and blue, rare, 9.6.48, *Rawi* 12213.

Our plants differ from the typical *D. saniculifolium* in flower size (20–24 mm. long, not 16–20 mm.), and in the flowers appearing paler, at least in sicco, from var. *aquilegifolium* in the more obtuse spur and in the bracteoles being at the base of the flower stalk and from *D. quercetorum* Boiss. in being larger and more glabrous in all parts. *Rawi* 12213 and *Bornmüller* 6062 from the Schimran mountains in Persia appear to be intermediate between *D. saniculifolium* and *D. quercetorum*. As our plants are not a perfect match for each other and appear intermediate between species already described, they are not recognized as a new species. It seems probable that further study may reduce these three to one polymorphic species.

Distrib. (of *D. saniculifolium*). Pers., Afghan.

D. tomentosum *Auch.* (*D. oliganthum* Boiss.).

Meer Khasim between Balad Sinjar and Tal Afar, 30.5.34, *H. Field and Yussef Lazar* 538 ; Tal el Shour between Tal Afar and Balad Sinjar, 1.6.34, *do.* 586 ; 30 km. due west of Balad Sinjar, 7.6.1934, *do.* 691 ; Jabal Bekheir near Zakho, 15–18.6.34, *do.* 830 ; Arbil, 400 m., cornfields (moist type steppe), mauve, 7.5.1947, *Gillett* 8011 ; c. 10 km. south of Mosul, c. 300 m., moist type steppe, rocky hills, purple, flowers nearly regular apart from spur, 27.5.48, *do.* 1171.

Huth (l.c.) distinguishes var. *brachycentrum* Huth and var. *ponticum* Huth but their characters do not seem to contrast very clearly.

Both Bornmüller p. 98 (1911) and Handel-Mazetti p. 43 (1913) record *D. pygmaeum* Poir. (*D. pusillum* Labill.) from 'Iraq. Huth regards Bornmüller's specimen as *D. oliganthum*. Examination of material available at Kew rather suggests that *D. pygmaeum* is only a depauperate form of *D. oliganthum* ; some of the material cited above has entire lower bracts and comes to *D. pygmaeum* in Huth's key. It has, however, been identified as *D. oliganthum* for the reasons given.

Examination of material cited as *D. oliganthum* Boiss., by Boissier suggests that this species is not distinct. There is some variation in petal-shape (rather exaggerated in Huth's t. VII, figs. 7, 8) and in flower size but the specimens do not seem to fall into two good species. No material has been seen under either epithet in which the carpels are erect.

Garidella *Tourn.*

A. Claw of petals shorter than sepals, limb bilobed, lobes linear tapering ; seeds ovate reticulate . . . . . *Garidella nigellastrum* L.

AA. Claw of petals longer than sepals, limb reniform undulate ; seeds oblong reticulate and transversely deeply sulcate *G. unguicularis* Lam.

Garidella nigellastrum *L.*

Kursi, Jabal Sinjar, Mosul liwa, 750 m., irrigated fig gardens near village, limestone, lower margin of *Quercus* forest, petals blue–white, short-clawed, deeply notched, locally common, 24.5.48, *Gillett* 11002 ; Jindian above Rowanduz, Arbil liwa, 600 m., limestone, *Q. aegilops–Q. infectoria* forest, base slopes, petals bluish, 15.5.47, *Gillett* 8291.

There is a monograph of *Nigella* (including *Garidella*) by Brand in Helios **13** (1896), of which there is a typescript in the Kew library. Brand's delimination of some of his species has not been accepted here. The key given above is based on an examination of the material and not on Brand's key.

G. unguicularis *Lam.*

Kursi, Jabal Sinjar, Mosul liwa, 750 m. limestone, lower margin of *Quercus* forest, irrigated fig garden near village, petals long clawed crimson with yellow markings, locally frequent, 25.5.48, *Gillett* 11001.

Distrib. Cyprus, Asia Minor, Pal., Syria, 'Iraq.

Myosurus minimus *L.*

Mesopotamia, *Aucher-Eloy* 17.

Bornmüller also records this from between Baghdad and Kirkuk, south of Jabal Hamrin p. 94 (1911)).

Nigella *L.*

A. Fls. yellowish ; involucre longer than fls. ; carpels flattened c. 2 cm. long (excluding beak) . . . *Nigella oxypetala* var. *tenuifolia* Boiss.

AA. Fls. bluish, involucre not longer than fls. ; carpels scarcely flattened, 1–1·5 cm. long (excluding beak)

B. Anthers obtuse ; capsules ovoid, carpels joined to apex . *N. sativa* L.

BB. Anthers ± mucronate ; capsules obconic, carpels joined to about middle then divergent.

C. Sepals c. 5 mm. long, anthers very shortly mucronate (mucro under 0·5 mm. long) . . . . . *N. assyriaca* Boiss.

CC. Sepals 8–10 mm. long, anthers with mucros 0·5–1 mm. long. *N. arvensis* L. var. *caudata* Boiss.

Nigella assyriaca *Boiss.*

Between Baghdad and Kermansha, May 1836, *Aucher-Eloy* 48 ; Northern Jazira, W. of Mosul, June 1932, *B. P. Uvarov* s.n. (B.M.).

N. oxypetala *Boiss.* var. **tenuifolia** *Boiss.*

Arbil, 400 m., cornfields, moist type steppe, calyx yellow, occasional, 7.5.47, *Gillett* 8006 ; Jindian above Rowanduz, Arbil liwa, 1000 m., limestone, coppiced *Quercus aegilops–infectoria* forest with grass, calyx greenish, yellow, frequent, 15.5.47, *do.* 8285 ; Bekheir, Mosul liwa, 1200 m., 7.5.47, *Rawi* 8966A×.

[**Paeonia arietina** *Anders.*

Mountains of Kurdistan, *Layard.*

Possibly this specimen is not from 'Iraq. The leaflets are villose on the undersurface (glabrous in var. *orientalis* (Thiebaut) Stern), the flowers 8–12 cm. diam., and with red petals ; the carpels are pubescent with coarse white hairs (see Col. F. C. Stern " A Study of the Genus Paeonia " 1946)].

P. kurdistanica *Zohary* in Pal. Journ. Bot. ser. J. **2,** 155 (1941) e descr.

Zohary describes this as nearly related to *P. vithmaniana.* His specimen is cited as " Iraq : Kurdistan : env. of Sursink, deep shady gorge, 920 m., rocks (1933 *Evenari*) ". It is only known from fruiting material. The leaflets are described as glabrous on both surfaces ; the carpels as densely and adpressed tomentose with yellow matted hairs.

Ranunculus *L.*

I. **Batrachium**—Petals white, nectary scale minute or none. Leaves finely divided into hair-like segments. Aquatic plants.

A. Peduncles longer than the leaves

B. Flowers large 12–15 mm. diam. ; receptacle hairy ; leaf segments collapsing . *R. heterophyllus* Weber var. *submersus* (Gren. et Godr.) Babington.

BB. Flowers medium to small, 5–12 mm. diam., receptacle hairy

C. Leaf segments collapsing ; achenes with a few bristles or glabrous *R. pseudo-fluitans* Baker et Fogitt var. *minor* Pears.

CC. Leaf segments not collapsing, leaves ± circular in outline when dried ; achenes with a few bristles . . . *R. circinatus* Sibth.

AA. Peduncles shorter than leaves ; flowers small 5–12 mm. diam. ; receptacle hairy ; achenes glabrous ; leaf segments collapsing *R. trichophyllus* Chaix subsp. *drouetii* (F. Schultz) Clapham.

II. **Ficaria**—Calyx with 3 sepals. Petals 7–12, yellow. Leaves simple ovate cordate, margin crenate. Land plants in moist places. *R. kochii* Ledeb.

III. **Euranunculus**—Calyx with five sepals ; petals yellow (red or white in *R. asiaticus*) with scale-like nectaries at base ; leaves divided (except *R. ophioglossifolius*) ; land or marsh plants.

A. Flowers 3 or more cm. diam., petals usually red sometimes pink, yellow or white ; fruiting inflorescence cylindrical (1·5 cm. long, 0·6 cm. wide or larger) ; leaves ± divided . . *R. asiaticus* L.

AA. Flowers under 3 cm. diam., petals yellow ; inflorescence in fruit globular or if cylindrical under 1 cm. long ; leaves various

B. Leaves undivided ; flowers 5–9 mm. diam. ; achenes c. 1 mm. long *R. ophioglossifolius* L.

BB. Leaves divided ; flowers and achenes various

C. Annuals

D. Flowers up to 8 mm. diam. ; achenes margin smooth centre transversely rugulose c. 1 mm. long . . . *R. sceleratus* L.

DD. Flowers various ; achenes spiny or tuberculate up to 3–15 mm. long

E. Achenes glabrous, beak up to 3 mm. long

F. Achenes with a smooth margin ; sepals reflexed ; leaves ± ovate in outline

G. Flowers up to 7 mm. diam. ; achenes tuberculate in centre ; peduncles incrassate ; leaves divided halfway at the most *R. chius* DC.

GG. Flowers 10–20 mm. diam. ; petals oblong ; achenes spiny in centre ; peduncles not incrassate ; leaves palmatisect *R. muricatus* L.

GGG. Flowers 12–24 mm. diam. ; petals obovate ; achenes tuberculate in centre ; peduncle incrassate ; leaves palmate

H. Beak half as long as tuberculate ovary *R. lomatocarpus* F. et M.

HH. Beak as long as tuberculate ovary *R. lom.* var. *cornutus* (Post) DC.

HHH. Beak half as long as smooth ovary *R. lom.* var. *leiocarpus* Boiss.

FF. Achenes spiny to margin ; sepals spreading ; flowers 8–13 mm. diam. ; lower leaves cuneate-oblong trifid, upper leaves ternate segments petiolulate lanceolate trifid at apex *R. arvensis* L.

EE. Achenes adpressed pubescent, margin smooth, centre slightly tuberculate or smooth, beak large 6–16 mm. long recurved-circinnate ; flowers 7–10 mm. diam. . *R. pinardi* (Stev.) Boiss.

CC. Perennials

I. Stem and leaves conspicuously hairy ; lowland and alpine plants

J. Leaves divided to the base

K. All leaflets divided into numerous hairy oblong linear or narrow lanceolate segments up to 2 mm. wide ; achenes glabrous or hairy

L. Achenes glabrous, smooth, beak ascending ; leaf segments linear-oblong usually less than c. 5 mm. long
R. millefolius Boiss.

LL. Achenes hairy (rarely glabrous) smooth or tuberculate, beak recurved ; leaf segments oblong linear usually more than 10 mm. long.

M. Beak of achene up to 4 mm. long

N. Achenes hairy . . . . *R. dasycarpus* (Stev.) Boiss.

NN. Achenes glabrous
R. dasycarpus var. *leiocarpus* Zohary

MM. Beak of achene 5–7 mm. long
R. macrorrhynchus Boiss.

KK. Leaf-segments 20–50 cm. wide ; achenes glabrous

O. Cauline leaves well developed, acute ; calyx spreading ; style straight or slightly recurved
R. sericeus Banks et Sol.

OO. No cauline leaves other than inflorescence bracts obtuse or acute ; calyx reflexed ; style strongly recurved . . . . . *R. constantinopolitanus* Urv.

JJ. Radical leaves not divided to base

P. Style straight

Q. Radical leaves 3-lobed each lobe divided into 5 or fewer lobes at apex ; calyx spreading, petals obovate ; achenes hairy margin smooth centre tuberculate . . . . . *R. cuneatus* Boiss.

QQ. Radical leaves 3-lobed each lobe divided into 7 or more at apex ; calyx reflexed, petals oblong-obovate ; achenes glabrous margin smooth centre slightly tuberculate . *R. oxyspermus* MB.

PP. Style recurved . . *R. constantinopolitanus* Urv.

II. Stem and leaves glabrescent or sparsely hairy ; alpine plants

R. Cylindrical root-tubers as well as fibrous roots ; no ring of fibres (old leaf bases) at crown ; flowers 6–20 mm. diam. ; calyx glabrous or hairy

S. Plants up to 8 cm. tall ; sepals glabrous ; 1 or 2 flowers on each stem

T. Flowers 12–20 mm. diam. ; achenes glabrous (f. Boiss.) . *R. bulbilliferus* Boiss. et Hoh.

TT. Flowers 6–15 mm. diam. ; achenes inflated glabrous, style ascending straight
R. myosuroides Boiss.

SS. Plants up to 20 cm. tall ; sepals and achenes hairy ; 3 or 10 flowers on each stem ; style circinnate-recurved, flowers c. 10 mm. diam.
R. trigonocarpus Boiss.

RR. No tubers although fibrous roots may be up to 1·5 mm. thick ; ring of fibres at crown usually present ; flowers 15–25 (rarely 8) diam. ; calyx hairy

U. Radical leaves palmate, ovate or orbicular in outline

V. Leaves trifid almost to base without petiolules ; calyx spreading

W. Leaflets acute or obtuse
R. brachylobus Boiss. et Hoh.

[WW. Leaflets rounded at apex
R. polyrrhizus Steph.]

VV. Leaves with petiolules, centre petiolule the longest ; calyx spreading or reflexed

X. Calyx reflexed, leaflet ± orbicular in outline

Y. Carpels hairy . *R. trichocarpus* Boiss.

YY. Carpels glabrous
R. trichocarpus var. *haussknechtii* Boiss.

XX. Calyx spreading, leaflet oblong-cuneate or lanceolate in outline
R. aff. *trichocarpo* Boiss. et Ky.

[UU. Radical leaves pinnatisect, oblong in outline ; calyx reflexed, carpels glabrous
R. crymophilus Boiss. et Hoh.]

In the critical group, *Batrachium*, an attempt has been made to name material from the Middle East according to the most recent work on British Batrachia (Clapham, Tutin and Warburg's Flora of the British Isles 1952 and Pearsall in B.E.C. Report **8,** 811–837 (1928)). Miss Ross-Craig's Drawings of British Plants part 1, 1948 and Butcher and Strudwick's Further Illustrations of British Plants 1946 have also been consulted. Naming 'Iraqi material by a British flora is only justified as, firstly, water-plants are often widely distributed and the same species may well occur in 'Iraq and Britain, and secondly no extensive modern work on the middle Eastern *Batrachia* has been published. In any case there appear to be intermediates between most species however defined and a

certain amount of arbitariness has been accepted in defining the species. It may be noted that *Batrachia* with a glabrous receptacle are not represented in the Oriental (Middle Eastern) material at Kew and only one specimen, from Cyprus, shows floating leaves. The names given here must be regarded as provisional only. No species has been included unless a specimen of it from 'Iraq has been seen.

Ranunculus circinatus *Sibth.* (*R. paucistamineus* Tausch. e Blakelock in Kew Bull. 379 (1948)).

Marshy places near Baquba, floating when water is deep or lying on the ground when shallow, 22.4.1920, *Graham* ; Gatt al Dwat, near Amara, 22.4.1934, *Field and Yussef Lazar* 1 ; Chehala near Amara, 26.4.1934, *do.* 40 ; Daltawa, in marshes, native name hunkrais-al-mai, 26.5.1932, *Guest* 2445 ; by old Abbaside bridge on main road near Balad, Baghdad liwa, 70 m., in pool (irrigated subdesert) locally abundant, white yellow at centre, native name zahallaq, 15.4.1947, *Gillet and Rawi* 6507 ; 3 km. S.E. of Daltawa, Diyala liwa, 50 m., in seepage pool by canal, dominant, corolla white yellow at centre, native name gambu-a or hangreis, 30.3. 1948, *Gillett and Rawi* 10209 ; [near Baquba, l.c. Mar. 1929, *Rogers* 040 : the terrestrial form ?]

Much Oriental material of this species was previously placed under *R. paucistamineus* Tausch. According to W. P. Pearsall in B.E.C. Report **8,** 820 (1928) " an examination of authentic foreign examples (and particularly those in Hb. Paris, for which I am indebted to Mr. Jas. Groves) shows that *R. paucistamineus* Tausch. is not synonymous with *R. Drouetii* F. Sch., but an aggregate species of much wider range—including *Drouetii*, *trichophyllus* and even large forms of our var. *submersus* so long as the flowers are not too large ". In view of this confusion, it seems best to drop the name *paucistamineus* for any Oriental *Batrachium* and to use, where possible, the name under which the plant is known in Europe.

R. trichophyllus *Chaix* subsp. **drouetii** (*F. Schultz*) *Clapham.*

Shaiba, Mesopotamia, 23.8.1919, [Iraq, ?] *G. A. Watson* ; Qarmat Ali near Basra, Basra liwa, 3 m., creeks among rather open date gardens, white, 14.2.1947, *Gillett and Rawi* 5975.

The achenes are glabrous in these two specimens as in Clapham's description of this subspecies. Some Oriental specimens (Asia Minor ; Gaziantep, 1934, *Balls and Gourlay* 838 ; Egypt : Tamieh in Fayum, 1879, *Schweinfurth* 49) have collapsing leaf segments and achenes with bristles towards the apex i.e. intermediate between Clapham's subsp. *trichophyllus* and *drouetii*. Schweinfurth's specimen has been described by Freyn as *R. aschersonii* in Beilage z. Bot. Centralblatt nr. 26, p. 13 (1881) (at end of Bot. Centralbl. band **6,** (1881)).

R. pseudofluitans *Baker et Fogitt* var. **minor** *Pears.* in B.E.C. Report **8,** 829 (1928).

Khermal, Sulaimaniya liwa, c. 700 m., pool, white, 22.4.1947, *Rawi* 8924.

This differs from *R. trichophyllus* var. *drouetii* mainly in the peduncle being longer than the leaf. It does not fit into Clapham, Warburg and

Tutin's key, but in Pearsall's it comes to *R. pseudofluitans* Baker and Fogitt var. *minor* Pears. This name is provisionally used for the abundant material at Kew, which has the characters indicated above.

The notes on *Euranunculus* and *Ficaria* are given below separately from those on *Batrachium*.

R. argyreus *Boiss.*

Bornmüller p. 95 (1911) records this from Kurdistan : Kuh-i-Sefin (östlich von Erbil [Arbil]), Abhange bei Schaklawa [Shaqlawa], ca. 1100 m., 21.5.1893, 824. This specimen has not been seen, but other material of this species at Kew does not appear to be specifically distinct from *C. cuneatus* Boiss.

R. brachylobus *Boiss. et Hoh.*

In montis Helgurd [Arl Gird Dagh], regione alpina, 3000 m., 26.6. 1893, *Bornmüller* 828 ; Lalan-Arl Gird Dagh, Arbil liwa, 1600–3000 m., wet grassy spots by springs, igneous or metamorphic rock, common, yellow, 23.8.1948, *Gillett* 12448.

Distrib. Bulgaria, Cauc., Asia Minor, N. 'Iraq, N. Pers.

R. bulbilliferus *Boiss.* et *Hoh.*

Kurdistan, Riwandous (ad fines Pers.) in m. Helgurd [i.e. Arl Gird Dagh nr. Rowanduz], 26.6.1893, *Bornmüller* 827.

R. chius *DC.*

Sarchinar nr. Sulaimaniya, 850 m., cultivated land near river, yellow, common, 16.4.47, *Gillett* 7691 ; Khermal, Sulaimaniya, c. 650 m., 21.4.1947, *Rawi* 8966 Y ; Daltawa, Diyala liwa, c. 60 m., by paths, etc., in Date gardens, yellow, abundant, 18.3.1948, *Gillett and Rawi* 10218 ; Shaqlawa, Arbil liwa, 900 m., among irrigated gardens, yellow, locally common, 26.3.48, *Gillett and Rawi* 10461.

R. constantinopolitanus Urv. var. **geraniifolius** (*DC.*) *comb. nov.* *R. lanuginosus* L. var. *geraniifolius* DC. in Prod. **1,** 37 (1824) ; var. *dissectus* Boiss. Fl. Or. **1,** 49 (1867).

Bornmüller collected this on the Arl Gird Dagh, nr. Rowanduz, 3000 m., 26.6.1893, 810 (p. 96 (1911)).

[**R. crymophilus** *Boiss.* et *Hoh.* var. **major** *Boiss.* Fl. Or. Suppl. 14 (1888).

Boissier records this as " hab. ad nives in montibus Avroman et Schalm [sic] Kurdistaniae Persicae 9–10000′ (Haussk. !)" There is a specimen at Kew "ad nives m. Schahu 10000′, Juli 1867, *Haussknecht* ", which presumably represents the same gathering. This may be from the border of 'Iraq if not in it].

R. cuneatus *Boiss.*

Jabal Sinjar above Kursi, Mosul liwa, 800 m., limestone, denuded *Quercus aegilops brantii* forest, in fruit, occasional, 23.5.1948, *Gillett* 10966.

Zohary (in Pal. Journ. Bot. J. Ser. **2,** 152 : 1941) places Guest's material from Rowanduz Gorge collected in 1932 as var. *lobatus* Boiss. 31 : 1867), but the distinction from the typical form does not seem very great.

Distrib. Asia Minor, Syria, N. 'Iraq.

R. dasycarpus (*Stev.*) *Boiss.* var. **leiocarpus** *Zohary* in Pal. Journ. Bot. J. Ser. **2,** 152 (1941).

Zohary describes this as " carpella glabra cetera ut in typo ". His specimen is from 7 km. S. of Khanaq (N. of Mosul), c. 500 m., hills, compact soil, 1933, *Eig, Feinbrun* and *Zohary.*

R. kochii *Ledeb.* (*R. edulis* Boiss. et Hoh.).

Anthony p. 279 (1935) records *R. calthifolius* Jord. from Sulaimaniya. This is presumably *Graham* 769, which is at Kew and has the narrow petals of *R. kochii.* There is additional material of this species :—

Shaqlawa, Arbil liwa, 250 m., *Quercus* forest on limestone, yellow, 25.3.1948, *Rawi* 10453.

R. lomatocarpus *F. et M.* var. **cornutus** (*DC.*) *Post.* in Fl. Syr. Pal. and Sinai ed. 1, 42 (1896).

Acra, Mosul liwa, 31. 5.48, *Rawi* 11376.

R. lomatocarpus F. et M. var. *scandicinus* Boiss. Fl. Or. 1, 55 (1867) is recorded in Boiss. Fl. Or. Suppl. 14 from " Kurdistania ad radices montis Pir Omar Gudrun (Haussk. !) ". Haussknecht's specimen has not been seen, but other specimens cited as var. *scandicinus* (*Kotschy* 423, 485) are at Kew. These resemble *R. lomatocarpus* but have the beak of the achene only up to 1 mm. long. In 'Iraq there is variation in beak-length from 1 to 4 mm. in specimens otherwise resembling *R. lomatocarpus.* It seems preferable for the time being to include this variety in *R. lomatocarpus.*

Zohary describes a *R. trachycarpus* var. *galileus* from Palestine as intermediate between these two species (in Pal. Journ. Bot. J. ser. **2,** 152 (1941)).

R. macrorrhynchus *Boiss.*

Bornmüller p. 95 (1911) records this species from " Schaklawa am Kuh-i-Sefin, ca. 1100 m., 11.5.1893, no. 821." He regards it as probably only a variety of *R. dasycarpus.*

Distrib. Asia Minor, N. 'Iraq.

R. muricatus *L.*

Acra, Mosul liwa, 31.5.1948, *Rawi* 11389.

The centres of the carpels are smooth, although there is a ring of spines towards the margin. Intermediate between the typical form and var. *leiodiscus* Boiss.

The palmatisect leaves of *R. muricatus* distinguish this species from the palmate leaves with petiolulate leaflets of *R. lomatocarpus* so far as large

range of specimens from 'Iraq is concerned, but this character " breaks down " when two specimens at Kew, which have palmatisect radical leaves, are examined. The flowers are those of *R. lomatocarpus*. The fruit of the Lebanese specimen approaches *R. muricatus*. Possibly they are hybrids. The two specimens are :

Mesopotamia : Karun, 23.8.1919, *G. A. Watson* ; Lebanon : below Choueifat, March 1943, *P. H. Davis*.

Another specimen may be mentioned here (*Rogers* 051). Although resembling *R. muricatus* in other characters, it has the petals obovate rather than oblong. This may be of the same hybrid origin as the two above.

Left bank of Tigris, N. of Baghdad, Mar. 1929, *Rogers* 051.

There is also a series of specimens from Cyprus whose characters appear intermediate between *R. trachycarpus* and *R. muricatus*, but these need not detain us here.

R. myosuroides *Boiss.* et *Kotschy*.

Kurdistania, Riwandous (ad fines Pers.), in monte Helgurd, ad nives [Rowanduz, Arl Gird Dagh], 26.6.1893, *Bornmüller* 826.

Leaves wider than in type material at Kew, intermediate to *R. bulbilliferus* Boiss. et Hoh.

R. ophioglossifolius *L.*

Near Baquba, Mar. 1929, *F. A. Rogers* 038.

Distrib. Eur., Or., N. Afr., Canary Is.

R. pinardi (*Stev.*) *Boiss.* (*Gampsoceras pinardi* Stev.).

Pir Omar Gudrun above Zewiya, Sulaimaniya liwa, 1600 m., upper limit of trees, yellow occasional, 20.4.47, *Gillett* 7817.

[**R. polyrrhizus** *Steph.*

Kurdistan, *Olguin* [Herb. Hookerianum].

Possibly not from 'Iraq, but material of this species has been collected in the adjacent parts of Turkey. Like most of the material from 'Iraq in this group of *Ranunculus* (*R. bulbilliferus* onwards in key) there is no ripe fruit available and a certain element of doubt is therefore attached to their identification.

Boissier describes the carpels of *R. polyrrhizus* as pubescent, those of *R. brachylobus* as glabrous ; in both species the beak is uncinate (**1,** 27, 41).

Distrib. Asia Minor, N. Asia, Korea].

R. sceleratus *L.*

Babylonia australis, in palmetis ad Basra, 23.3.1893, *Bornmüller* 1 ; Mesaida near Amara, 28.4.34, *Field and Yussef Lazar* 73A ; Abul Khassi near Basra, o m., mud by creek, yellow, 11.2.47, *Gillett and Rawi* 5949.

Distrib. Eur., Or., across Asia to Japan (including India), N. America.

R. trichocarpus *Boiss.*

Kodo near Haji Omran, Arbil liwa, 2500 m., yellow, 22.6.1947, *Rawi* 9188 ; Arl Gird Dagh, 3000 m., scree, igneous or metamorphic rock, subalpine formation, yellow, 5.8.1947, *Gillett* 9589.

In 9188 it is rather difficult to say whether the carpels are going to be glabrous or not but the flowers and leaves are a match for *Bornmüller* 829. In 9589, although in other respects the specimen is somewhat imperfect, the hairy carpels of the typical form are clearly shown.

R. trichocarpus *Boiss. et Kotschy* var. **haussknechtii** *Bornm.* in Bull. Herb. Boiss. ser. II, **4,** 1080 (1904) et in Beih. Bot. Centrabl. **28,** abt. 2, 96 (1911).

Riwandous [Rowanduz] (ad fines Pers.) in m. Sakri-Sakran regione alpina, 2200 m., 28.6.1893, *Bornmüller* 829.

Described as " differt a typo carpellis glabris, folius semper 3-partitis laciniis ut in typo-lanceolatis vel obtusis ".

R. trigonocarpus *Boiss.*

Kurdistania (Assyr. Or.) in m. Kuh. Sefin, supra Schaklawa, Erbil [Shaqlawa, Arbil], 1100 m., 21.5.1893, *Bornmüller* 822 ; Pir Omar Gudrun above Zawiya, Sulaimaniya liwa, 1600 m., yellow, 20.4.1947, *Gillett* 7816A.

Distrib. Asia Minor, N. 'Iraq.

Thalictrum *L.*

A. Inflorescence once branched, up to 5-fl. ; achenes curved outwards style incurved ; leaf segments 10–20 mm. long about as broad, deeply 3–7-lobed at apex ; upper bracts as long as or longer than fruiting pedicels ; plant 10–20 cm. (rarely 30 cm.) high
T. sultanabadense Stapf

AA. Inflorescence often twice or thrice branched, many flowered ; upper bracts shorter than fruiting pedicels ; achenes straight style incurved

B. Leaf segments up to 7–15 mm. long, generally 3–7-fid at apex ; inflorescence 3-branched towards base ; plant 30–90 cm. high
T. minus L.

BB. Leaf segments 2–5 (rarely 8) mm. long, generally entire rarely 3-fid, inflorescence at most twice branched towards base upper branches 1-flowered ; plant 15—25 (rarely 40) cm. high
T. isopyroides C.A.M.

Thalictrum isopyroides *C.A.M.*

Kurdistan, c. 6000 ft., Apr. 1929, *L. Smith* (*herb. Rogers*) 0207 ; Haji Omran, Arbil liwa, fls. purplish white, 25.4.1951, *Mooney* 4258 ; do., 1750 m., slates of nappe zone, *Astragalus* thorn cushion formation, S. aspect, 16.5.1948, *G. Chapman* 11193.

Distrib. Cauc., Asia Minor, Syria, 'Iraq, Pers., Afghan., Baluch., Sind, Centr. Asia.

T. minus *L.* var. **nutans** *Regel* in Bull. Soc. Imp. Nat. Mosc. **34,** 33 (1861).

Nábělek collected a variety he identified as this on Handren Dagh above Rowanduz, 2000 m., 23.5.1910, 4081 (p. 13 (1923)).

Boissier (**1,** 8 (1867)) describes this variety as glabrous, segments often glaucescent below acutely trilobed or incised. Var. *olympicum* is described as segments fairly large somewhat rigid coriaceous obtusely lobed and mucronate below glandular and with raised nerves. This species is very polymorphic in Europe and the 'Iraqi plant may prove to be equally so when it is better known ; so that too much importance should not be attached to varietal names.

T. sultanabadense *Stapf.*

Pir Omar Gudrun, Sulaimaniya liwa, 1200–1800 m., limestone mountain, coppiced *Quercus aegilops* forest, chiefly in shady corners, frequent, 19.4.47, *Gillett* 7768 ; Penjwin, Sulaimaniya liwa, 1200 m., occasional, 23.4.47, *Rawi* 8814 ; Salahaddin forestry enclosure, Arbil liwa, 800–900 m., *Quercus aegilops brantii* forest, coppiced, limestone, steep northern aspect in shade, stamens purplish brown, common, 24.3.48, *Gillett* 10429.

Nábělek p. 13 (1923) records this from Handren above Rowanduz.

Berberidaceae

A. Leaves all radical ; petals without scales but a nectar-secreting pore at base; 5–6 ovules . . . . . *Bongardia chrysogonum* (L.) Boiss.

AA. Stem leafy; petals with a shortly stalked scale at base inside; ovules 2–4 . . . . . *Leontice leontopetalum* L.

Zohary records *Leontice minor* Boiss. from the " Western part of the Syrian desert ". His specimen has not been seen, but from material from other countries and Boissier's description, this species may well be only depauperate plants of *L. leontopetalum.*

Pau and Vicioso (Trab. Mus. Nac. Cienc. Nat. no. 14, 12 : 1918) lists *L. leontopetalum* L. var. *eversmannii* (Bunge) from " Nihiyé (Eufrates) " [near Ana, Duleim liwa]. Of this variety, which he maintains as a species, Boissier (p. 100 : 1867) states that it is very close to *L. leontopetalum* differing in narrower leaf segments (but this character is variable), scales a millimetre long tridentate, capsule much smaller 18 -20 mm. long, and fruiting pedicels acute and not very obtusely angled.

Papaveraceae

A. Capsule ovoid to cylindrical, capsule opening by pores just beneath stigma . . . . . *Papaver* L.

AA. Capsule cylindrical, capsule opening by valves

B. Capsule opening by 3–4 valves, unilocular . . *Roemeria* Medic.

BB. Capsule opening by 2 valves, bilocular . . . . *Glaucium* Mill.

There is a monograph of this family, by F. Fedde (in Pflanzenreich **4,** 104, pp. 1–430 (1909)) which has been much used in preparing this account.

Glaucium Mill.

A. Sepals 1–2, rarely 2·5 cm. long ; flowers medium sized

B. Fruiting pedicel erect

C. Radical leaves pinnatipartite with oblong unequally toothed leaves ; peduncles shorter than leaves

D. Petals orange with dark blood-red spot at base *G. corniculatum* var. *phoeniceum* (Crantz) DC.

DD. Petals yellow . . . . *G. corniculatum* var. *flaviflorum* DC.

CC. Radical leaves lyrate-pinnapartite with ovate segments obtuse 2–3-dentate ; peduncles longer than leaves . *G. arabicum* Fres.

BB. Fruiting pedicel recurved . . . . . *G. refractum* Nábělek

AA. Sepals 2·5–5 cm. long ; flowers large

E. Sepals hairy or papillose

F. Fruiting pedicel erect . . . . . *G. grandiflorum*

FF. Fruiting pedicel recurved *G. grandiflorum* var. *helissopelma* Fedde

EE. Sepals glabrous . . . . *G. aleppicum* Boiss. et Haussk.

Glaucium aleppicum *Boiss. et Haussk.*

This species is listed by Anthony p. 280 (1935) from Ramadi.

Distrib. Pal., Syria, 'Iraq.

G. arabicum *Fres.*

Handel-Mazetti p. 45 (1913) records this from " Am Euphrat an Kalksfelsen bei Haditha unter Ana (Nr. 783) und in Kieswüste unterhalb Hit (Nr. 831) " with the note " sepala et fructus juveniles dense setuloso-tomentelli ".

G. grandiflorum *Boiss. et Huet* var. **helissopelma** *Fedde* in Pflanzenr. **4,** 104, p. 227 (1909).

Kani Mazi (nr. Khanaqin), 210 m., on dry stony soil at the edge of a cornfield, 29.3.1932, *Guest* 1842 ; Naft Khana, 150 m., on shale banks, a very beautiful flower, delicate scarlet petals with yellowish border, smell very fragrant, 29.3.1932, *Guest* 1859 ; Rutba, 10–12.5.1934, *Field and Yussef Lazar* 138.

These were previously placed in *G. corniculatum* var. *phoeniceum* (Crantz) DC., but on re-examination they have been transferred to *G. grandiflorum*. This variety seems to differ very little from *G. refractum* Nábělek ; the

length of the sepals being the main distinguishing character. *Field and Yussef Lazar* 138 is a mixture of var. *helissopelma* and *G. corniculatum*.

Fedde quotes, as *G. haussknechtii* Fedde et Bornm., a specimen collected by Strauss between Kermansha and Baghdad by Chanikin [Khanaqin] in Apr. 1894 (in Pflanzenr. **4,** 104, p. 227 (1909)). This he distinguishes from *G. grandiflorum* as follows :

" 1. Caules pauci velati, folia basalia longitudine valde superanti
3. *Gl. grandiflorum*

2. Caules multi, dense rosulatim enascentes, folia basalia juniora subaequantia . . . . . 4. *Gl. haussknechtii* "

Even if the emendations " superantes " and " subaequantes " are made, the distinction does not seem to be very great. *G. haussknechtii* is best regarded as a doubtful species until further material or other information is available.

G. refractum *Nábělek* e descr. et icon.

4 km. N.W. of Rawa, Duleim liwa, c. 200 m., gypaceous limestone, dry steppe-subdesert transition, occasional, corolla coppery red, 29.3.1947, *Gillett and Rawi* 7075 ; Sa-adiya, Diyala liwa, stony hills, Ausej wadi, fls. yellow, 10.5.1948, *Shaker M. Nuri* 11918.

These show the " pedunculis incurvis et siliquis arcuatis " as described by Nábělek. The flowers are red in 7075, not yellow as in the original description, but as the petals colour varies in *G. corniculatum* (L.) Curt., it may well do so in this species as well.

Papaver *L.*

A. Annuals, stigmatic disc flat or hemispherical

B. Hairy herbs, green, cauline leaves not amplexicaul

C. Stigmatic disc almost flat, margin crenate, crenations free or touching each other always rounded or subobtuse, never acute ; capsule glabrous

D. Peduncle with spreading hairs ; capsule subglobose or obovate
P. rhoeas L.

DD. Peduncle with adpressed hairs ; capsule elongated (twice as long as wide or more), narrowed towards base . *P. dubium* L.

CC. Stigmatic disc ± hemispherical, not flat on upper surface, rays keeled protruding as ± acute or obtuse teeth at the margin

E. Capsule ± setulose (*P. argemone* var. *glabrum* excepted) ; stigmatic rays less keeled, sinuses between them not reaching the centre of the disc

F. Capsule clavate, oblong-cylindrical or almost tubular

G. Sparse bristles all over capsules . . . . *P. argemone* L.

GG. Sparse bristles towards apex of capsule or capsule glabrous
P. argemone var. *glabrum*

FF. Capsule ellipsoid, ovoid or obovate globose . *P. hybridum* L.

EE. Capsule glabrous or setulose ; stigmatic rays keeled, sinuses between almost reaching centre of disc

* Capsule glabrous

H. Capsule elliptic-oblong, 1–1·5 cm. long

HH. Capsule oblong-tubular, 2–2·5 cm. long

* * Capsule setulose . . . . . *P. bornmulleri* Fedde

BB. Glabrous or sparsely hairy herbs, glaucous, cauline leaves amplexicaul

I. Capsule globose or subglobose, stigmatic rays 8–12 (rarely 5–18)

J. Very sparsely setulose ; leaves subentire . *P. somniferum* L.

JJ. Glabrous except peduncles ; leaves pinnatilobate *P. glaucum* Boiss. et Hssk.

II. Capsule obovate-oblong

K. Stigmatic rays 6 ; glabrous herb . *P. rogersii* Exell

KK. Stigmatic rays 6–8 ? ; peduncles adpressed hairy *P. aff. rogersii* Exell

AA. Biennials, stigmatic disc ± pyramidal, or umbonate

L. Capsule setulose . . . . . *P. tauricolum* Boiss.

LL. Capsule glabrous

M. Capsule smooth, subglobose or obovoid or oblong

N. Capsule oblong equally narrowed at base or apex *P. floribundum* Desf.

NN. Capsule subglobose . . . *P. acrochaetum* Bornm.

NNN. Capsule obovoid, narrowed at apex *P. fugax* var. *microcarpum*

MM. Capsule torulose, narrowly ellipsoid or ovoid, narrowed at both ends

O. Plant 23–55 cm. high, buds glabrous, fruiting peduncles erect . . . *P. armeniacum* (L.) DC.

OO. Plant c. 20 cm. high, buds setulose, fruiting peduncles recurved-arcuate . . . *P. curviscapum* Nábk.

This key is based on that of Fedde. It must be admitted that specimens exist which are not readily placed in it (e.g. *Guest* 4106, which resembles *P. rhoeas*, but has a slightly umbonate disc to capsule). As hybridity is well known in this genus in Europe, and there is some morphological evidence that the Middle Eastern species also hybridize, it is probable that any other arrangement of the species in a key would be no more satisfactory.

P. acrochaetum *Bornm.*

Fedde (p. 350) records this as :—

Kuh Sefin near Schaqlawa [Shaqlawa], 1892–3, *Bornmüller* 842.

P. argemone *L.*

Sefin Dagh near Shaqlawa, Arbil liwa, 1200 m., occasional, under limestone rocks, *Quercus* forest formation, scarlet, 9.5.1947, *Gillett* 8099 ; Jabal Sinjar above Kursi, Mosul liwa, 800–1000 m., frequent, limestone mountain with relics of *Quercus aegilops brantii* forest and terraced fig-gardens, scarlet, 24.5.1948, *Gillett* 11026 ; Haji Omran near Hotel, Arbil liwa, 1750 m., *Astragalus* thorn cushion zone on igneous or metamorphic rock, 3.6.1948, *E. Chapman* 11955.

8099 and one specimen of 11955 approximate to Fedde's description of var. *glabrum* Koch " capsula omnino glabra vel setis ad apicem per-paucis minita ". Fedde records this variety from Pir Omar Gudrun.

Distrib. C. & S. Eur., Cyprus, Asia Minor, Pal., Syr., Jordan, 'Iraq, Pers., N. Afr., Canary Is.

P. bornmulleri *Fedde.*

The specimen described by Fedde from 'Iraq was :—Shaqlawa on Kuh-Sefin, in mountains east of Arbil, 1892–3, *Bornmüller* 843.

From the description *P. bornmulleri* might possibly be a hybrid of *P. macrostomum* and some species with a setulose capsule. This possibility is supported by the variable nature of the plant recorded by Nábělek (p. 1923) who collected it on Handren Dagh near Rowanduz (no. 810). He states " petala variant ; aut immaculata omnia aut bina maculata, bina immaculata, aut omnia nigro-maculata. Macula modo distincta, albo-marginata, modo diluta. Foliorum forma valde variabilis."

P. curviscapum *Nábělek* e descr. et icon.

Matina [between Zakho, Amadia and Dohuk], Mosul liwa, 1200 m., rare, red, 15.5.1947, *Rawi* 8741 ; cult, in the Herbarium Ground, R. B. Gardens, Kew, from seed cited above, petals brick red (Saccardo 18) anthers whitish, filaments purple, white towards base, stigma purple, latex yellow, 7 and 24.3.1950, K. 3070.

The stigmata are papillose as they are *P. armeniacum* (L.) DC., although Fedde's key states that they are glabrous in the latter species.

P. dubium *L.*

Jabal Sinjar north of the town, Mosul liwa, 900–1300 m., limestone mountain with coppiced *Quercus* and ancient terraces, no present cultivation, locally common, brick red, black at base, 26.5.1948, *Gillett* 11119 ; spur of Jabal Avroman north of Biyara, Sulaimaniya liwa, 1800 m., limestone mountain coppiced *Quercus aegilops* forest, steep places, red with black blotch at base, frequent, 7.6.1948, *Gillett* 11787.

Distrib. C. & S. Eur., Or., Transcaspia, N. W. Himalaya, N. Afr., Atl. Is., Abyssinia.

P. floribundum *Desf.* var. **holosericeophyllum** *Fedde* Pflanzenr. **4,** 104, p. 350 (1909).

Nábělek p. 20 (1923) records this from " Kurdistaniae Turcicae distr. Berwari : mons Choarra-Sia supra pagum 'Ain Nune [Kani Mazi] inter pagos Amadia et Hasitha in graminosis alt. ca. 1400 m., 16.VI.1910 (No. 815). Folia inter setas rigidas patulas setulis parvis albidis dense obtecta."

P. fugax *Poir.* var. **microcarpum** (*Boiss.*) *Fedde* in Pflanzenr. **4,** 104, p. 351 (1909).

Sefin Dagh above Shaqlawa, Arbil liwa, 1200–1400 m., limestone rocks, *Quercus* forest formation, pale brick red, occasional, 9.5.1947, *Gillett* 8125 ; Spindar, Mosul liwa, 1200–1400 m., red, 25.6.1947, *Rawi* 9245 ; Jabal Avroman N. of Biyara, Sulaimaniya liwa, 1800 m., shaded limestone screes, *Quercus aegilops* forest formation, occasional, bright brick red, 7.6.1948, *Gillett* 11792.

Our material is a good match for *Kotschy* 385 from Mount Gara. The variety is described by Fedde as " Folia abbreviata, pinnatiloba. Capsula minuta glabra, vix 1 cm. longa ". Fedde expresses some doubt if it should be included in this species. The typical form, which is not recorded from 'Iraq, is characterised as " Folia pinnatifida vel pinnatipartita ".

Distrib. (of sp.). Asia Minor, N. Pers. (of var.) N. 'Iraq.

P. glaucum *Boiss. et Haussk.*

South bank of Euphrates opposite Rawa, Duleim liwa, 150 m., locally abundant, smaller specimens on limestone crags (subdesert–dry steppe climate), larger ones by irrigation channel, scarlet, 28.3.1947, *Gillett and Rawi* 7046 ; Jabal Hamrin on Baquba–Khanaqin road, Diyala liwa, 150 m., frequent, gypsaceous sandy hills, dry steppe–subdesert border, petals scarlet with a dark blotch, powdered and used to raise blisters, native name ward ahmar, lala (T), gula nisan (K), 11.4.1947, *Gillett and Rawi* 7312 ; Jabal Sinjar above Kursi, Mosul liwa, 700–1000 m., very abundant, irrigated cereal fields at 700 and terraced fig-gardens at 800–900 m., limestone, *Quercus* forest formation, scarlet with black centre, *Gillett* 10893.

P. rhoeas *L.*

Baghdad, in gramin. May 1868, *Haussknecht* ; Mosul, 17.5.1946, *Rawi* 5626 ; Badra, Kut liwa, 100 m., dry steppe–subdesert, in slight dip, frequent, scarlet, 18.3.1947, *Gillett* 6622 ; Haditha, Duleim liwa, 120 m., weed in irrigated *Ervum lens* and also in the dry steppe and on crags and in wadi beds, common, native name shaqaiq an numan, 26.3.1947, *Gillett* 6906.

Distrib. Eur., Asia Minor, Syria, 'Iraq, Pers., N. Afr., Atl. Is., Centr. & N. Asia, (N. America).

P. rogersii *Exell.*

Arbil, Apr. 1920, *Graham* 659 ; nr. Rutba Wells, April 1933, *H.R.P. Dickson* I.

Dickson's specimen has an eleven-radiate stigma and is only doubtfully identified as this species.

Distrib. 'Iraq.

P. tauricolum *Boiss.* (*P. persicum* Lindl.).

Khantur, Mosul liwa, 1200 m., occasional, mountainside, red, 11.5.1947, *Rawi* 8639 ; Acra, 31.5.1948, *Rawi* 11411.

The adpressed or spreading hairs on the capsules on which Fedde (p. 344) separates *P. tauricolum* and *P. persicum* does not seem to be a valid character even in his own figure 38. Examination of the material at Kew suggests that the only distinction is in the narrower leaf-lobing of *P. persicum* ; this does not seem sufficient on which to keep up a species.

P. tubuliferum *Fedde.*

Pir Omar Gudrun, 1200 m., 1867, *Haussknecht.*

Distrib. 'Iraq.

Burtt and Lewis (in Kew Bull. 281 : 1949) are inclined to regard Fedde's *P. daleschianum*, *P. kurdistanicum* and *P. divergens* as perhaps better included in *P. macrostomum.*

Roemeria hybrida (*L.*) *DC.*

In view of the amount of variation within this species, it seems advisable to include all the 'Iraq material as *R. hybrida* rather than as *R. dodecandra* (Forsk.) Stapf. Burtt and Lewis have a note on this (in Kew Bull. 281 : 1949).

Distrib. Widespread from W. Eur. and N. Afr. to Afghan. and Baluch.

FUMARIACEAE

A. Outer petal obovate ± 3-lobed, interior ones narrower ; no corolla spur . . . . . *Hypecoum* L.

AA. Corolla with a spur at the base

B. Two valved capsule . . . . . *Corydalis* DC.

BB. Small ± globose 1-ovulate indehiscent fruit . . . *Fumaria* L.

Corydalis *DC.*

A. Stem with a large scale at the base . . . . . *C. caucasica* DC.

AA. Stem without a scale at the base

B. Leaf segments linear-oblong . . . . . *C. verticillaris* DC.

BB. Leaf segments ovate or ovate-oblong . . . . *C. rutifolia* DC.

Corydalis caucasica *DC.*

Kurdistan, c. 6000 ft., Apr. 1919, *Rogers* 0205.

Distrib. Cauc., Asia Minor, 'Iraq.

C. verticillaris *DC.*

In montis Helgurd [Arl Gird Dagh] (ad fines Pers.), regione alpina, 3000 m.s.m., 26.6.1893, *Bornmüller* 846 ; Sulaimaniya, not common at

top of the pass, Apr. 1920, *Graham* 770 ; Haji Omran, Arbil liwa, 2266 m., on open summit of hill on phyllite, soil reaction pH 5, fls. dull purple (claret), 25.4.51, *Mooney* 4275 ; Pir Omar Gudrun, Sulaimaniya liwa, 2000 m., among small stones, frequent, pink with crimson tips to petals, 20.4.47, *Gillett* 7826 ; Kodo near Haji Omran, Arbil liwa, 22.6.47, *Rawi* 9198.

The specimens show a strongly curved corolla and are a fair match for Bot. Mag. 9486. Graham's specimen, although named by Fedde as this species, shows somewhat wider leaves and a less curved corolla. Despite the emphasis placed on the curvature of the corolla in Prain's Kew (in Bull. Herb. Boiss. **7,** 165–177, pl. 6 (1899)) it seems rather a variable character.

Guest 1260, 1387, 2078, 2079, 2080, previously named *C.* aff. *modestae*, are probably best included in *C. rutifolia* (Sibth.) DC. There is a possibility that *C. rutifolia* and *C. modesta* Prain are the same species, although von Poellnitz keeps them distinct. His revision is in Fedde Repert. Sp. Nov. **42,** 101-102 (1937) ; **44,** 154-157 (1938) ; **45,** 96–112 (1938) ; **46,** 310–314 (1939) ; **48,** 293–296 (1940).

Zohary p. 64 (1950) gives *C. solida* (Ehr.) Sw., a name taken from Guest p. 25 (1933). *Guest* 1206, which was named *C. solida* var. *densiflora* Boiss. by A. R. Horwood, is *C. caucasia* DC.

Fumaria *L.*

A. Bracts shorter than fruiting pedicels ; sepals narrower than corolla and not more than ⅓ as long ; corolla pink purple tipped

Corolla 7–9 mm. long . . . . . *F. officinalis* L.

Corolla 5–6 mm. long . . . . . *F. vaillantii* Lois.

AA. Bracts longer than fruiting pedicels ; sepals wider than corolla at least ⅓ as long ; corolla pink tipped with purple

B. Sepals nearly orbicular, more rarely ovate, leaf-segments wider ; corolla 6–7 mm. long . . . . . *F. micrantha* Lag

BB. Sepals ovate, leaf segments linear-setaceous ; corolla 3·5–4·5 mm. long . . . . . *F. bracteosa* Pomel.

AAA. Bracts about as long as fruiting pedicels ; sepals minute (0·5–1·5 mm. long) ; corolla white or pinkish with purple tip, 5–6 mm. long

C. Flowers pink, with wings of upper petal reflexed upwards *F. indica* Pugsl.

CC. Flowers white (sometimes tinged with pink) with erect spreading, patent or deflexed wings to the broad upper petal

D. Flower white except for purple tip

E. Leaf segments up to 0·5 (rarely 1) mm. wide ; fruit apiculate *F. parviflora* Lam.

EE. Leaf segments up to 1–2 mm. wide ; fruit obtuse *F. parviflora* var. *latisecta* Haussk.

DD. Flower tinged with pink with a green and purple tip ; fruit obtuse . . . . . *F. parviflora* var. *indicoides* Pugsl.

There is a monograph of the genus by H. W. Pugsley in Journ. Linn. Soc. **44,** 233–355 (1919), on which this key is based.

Fumaria bracteosa *Pomel.*

Bakouba [Baquba ?], near Baghdad, Apr. 1869, *Schläfli* 67; near Baghdad, Apr. 1935, *Field and Yussef Lazar* 518.

Distrib. Cyprus, Pal., 'Iraq, Pers., Egypt, Algeria.

F. indica *Pugsl.* ?

This species is known from 'Iraq from one imperfect specimen (*Mudir of Sinjar* 3132), doubtfully identified by Pugsley as this species.

Distrib. Pers., Baluch., Afghan., India, N. Asia.

F. micrantha *Lag.*

This is the same species as *F. densiflora* DC. in Zohary p. 65 (1950).

F. officinalis *L.*

Distrib. Eur., Or., N. Asia, N. Afr., Canary Is.

F. parviflora *Lam.* var. **latisecta** *Haussk.*

Mesopotamia, Sept. 1920, *Graham* (det. Pugsley as cf. v. *latisecta*); Kursi, Jabal Sinjar, Mosul liwa, 700 m., garden, corolla nearly white, 22.5.48, *Gillett* 10860; Penjwin, Sulaimaniya liwa, 1400 m., flowers white, 8.6.48, *Rawi* 12157; Haji Omran, Arbil liwa, 1750 m., *Astragalus* thorn cushion zone, cream, 3.6.48, *G. Chapman* 12285.

A sheet in the Rustam Herb. (*Mudir of Sinjar* 3134), previously named *F. indica* Pugsl. ?, is probably this variety.

F. vaillanti *Loesel.*

Nábělek p. 24 (1923) records this from " Babylon, vere 1909 leg. Dr. Reuter (No. 851) ". Handel Mazetti p. 46 (1913) from " Acker bei Sumedscha von dort gegen Mossul (Nr. 954) ".

Hypecoum.

A. Capsule erect or suberect

B. Exterior petals distinctly trilobed or subtrilobed . *H. procumbens* L.

BB. Exterior petals oblong entire or a little dilated at the middle *H. geslinii* Coss. et Kral.

AA. Capsule pendulous or subpendulous; exterior petals not trilobed *H. pendulum* L.

Hypecoum geslinii *Coss. et Krall.*

Zohary (in Proc. Linn. Soc. **153,** part 1, 101 (1944)) records this from Sulbie; Ar Rumail near Zubair.

H. procumbens *L.*

Zuhair, Basra liwa, 10 m., gravelly subdesert, yellow, locally frequent, 12.2.1947, *Gillett and Rawi* 6028.

The leaves of this specimen are more linear than in the rest of the material of the species, although it comes to this in Fedde's key (in Pflanzenr. **4,** 104, p. 86 (1909)).

THE GENUS HELIANTHEMUM (CISTACEAE) IN SOMALILAND

J. B. Gillett

Helianthemum somalense *Gillett*, sp. nov. a congeneribus omnibus inflorescentia brevissima, folia vix, vel haud, excedente, distincta.

Frutex 50–70 cm. altus, ramis erectis divaricatis, primo dense ferrugineo stellato-tomentosis, deinde glabratis, griseis vel rubris. *Folia* ad apicem ramulorum dense congesta, opposita, internodiis c. 2 mm. longis, omnino dense stellato-tomentosa ; stipulae lanceolatae, caducae, 2·5 mm. longae ; petiolus 1–3 mm. longus ; lamina elliptica integerrima, margine revoluta, apice, obtusa vel subacuta, nervo mediano et nervis lateralibus utrinque c. 4 supra impressis, subtus conspicuis, 11–23 mm. longa, 6–10 mm. lata. *Inflorescentia* cincinnus terminalis brevissimus sub umbelliformis, folia vix, vel haud excedens, c. 6-florus, omnino dense stellato-tomentosus, axe florifero c. 5 mm. longo, fructifero indurato, persistente, ad 10–15 mm. elongato, pedicellis ad 9 mm. longis, bracteis subulatis c. 1 mm. longis. *Sepala* 2 exteriora subulata, dense stellato-tomentosa 4 mm. longa ; 3 interiora oblongo-ovata, 3-nervata, apiculata, extus dense stellato tomentosa, intus glabra, c. 7 mm. longa, 3 mm. lata. *Petala* 5 flava, spathulato-obovata, glabra, 7 mm. longa 3·5 mm. lata. *Stamina* c. 100, glabra, filamentis ad 3 mm. longis, antheris 0·5 mm. longis. *Ovarium* dense tomentosum, placentis 3 lateralibus, ovulis in toto c. 30. *Stylus* glaber, valde curvatus, 4·5 mm. longus base 0·1 mm. diametro, sursum sensim incrassatus, apice 0·3 mm. latus, stigmate pluripapillato 0·7 mm. lato. *Capsula* pubescens, ovalis, c. 4 mm. longa, 3 mm. lata.

British Somaliland. Near Erigavo, limestone hill slopes, 15 Dec. 1953 *G. Popov* 1147 (Holotype, K) : –erect woody herb, height 60 cm., flowers yellow, Somali name WAN'AD. Moledere, 10°9″ N., 47°15″ E., c. 1500 m., 24 Jan. 1945, *Glover & Gilliland* 649 :—golden flowered shrublet of 50–70 cm. Somali name WANAD (abnormal in having 6 petals and sometimes 4 inner sepals).

Like the above but shoots 10–20 cm. long, springing from thick woody rootstocks, which have apparently been grazed off at ground level ; internodes longer (c. 7 mm.) ; leaves alternate, petals 5, stamens c. 50, flowers altogether smaller (sepals and petals c. 5 mm. long, 2 mm. wide).

Buran (Sorl) 10°13″ N., 48°47″ E., c. 900 m., on rocky ground, 6 Oct. 1929, *Collenette* 129 :—plant of 20 cm. ; flowers green ; stamens yellow, Somali (Warsangeleh) name GEDAD.

To what extent the differences recorded may be due to circumstances and how much to hereditary factors can only be decided when further gatherings are available.

H. somalense is the second species of *Cistaceae* to be described from tropical Africa, *H. gorgoneum* Webb from the Cape Verde Islands being the first. *H. ellipticum* (Desf.) Pers., a species widespread in the middle east, has been found just south of the tropic of cancer on the mountains of the central Sahara. In tropical Arabia one widespread species, *H. lippii* Pers., and one endemic closely related to *H. ellipticum*, *H. argyraeum* Bak., occur, though apparently rarely.

H. somalense is very distinct from these species and seems to occupy an isolated position in the genus. The numerous stamens would place it in section *Euhelianthemum* but the leaves sometimes alternate and the indurated persistent axis of the inflorescence suggest section *Eriocarpum*.

It is noteworthy that *H. somalense* has apparently not been found in the relatively moist spots along the crest of the coastal escarpment where evergreen scrub of *Buxus hildebrandtii* and forests of *Juniperus procera* at elevations of up to 2400 m. are the habitat of the southernmost outliers of several northern genera, such as *Ephedra*, *Lavandula* and *Coris* (see H. K. Airy Shaw in Kew Bull. **1951** : 29). Instead *H. somalense* is found at moderate elevations in relatively arid country well behind the escarpment. These facts (geographic and taxonomic isolation, adaptation to dry tropical conditions) taken together seem to show that *H. somalense* is not the result of any relatively recent immigration from the north, such as might have taken place during one of the cool pluvial periods which are believed to have occurred in Africa during the ice age, but is a relic of a much more ancient distribution of *Helianthemum* in tropical Africa.

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A NEW SPECIES OF CHIONODOXA FROM CYPRUS.

R. D. Meikle

Chionodoxa lochiae *Meikle* sp. nov. (Liliaceae), *C. luciliae* Hort. (? Boiss.) affinis, sed floribus maioribus, saturate caeruleis nec alboculatis ; antheris caeruleis nec albis ; filamentis ad apicem angustatis nec dilatatis nec emarginatis, valde differt.

Herba perennis e bulbo exorta. Bulbus subglobosus, circiter 1·5–2·0 cm. diametro, tunicis fuscis vel brunneo-fuscis vestitus. Folia erecta, circiter 15-nervia, 7–18 cm. longa, 4–8 mm. lata, linearia, apice subacuta, leviter cucullata, basin versus pedunculos longe amplectantia ; lamina in parte superiore olivaceo-viridis, colore aëris, suffulta, ad basin saepe aëreo-purpurea. Scapus solitarius, erectus, olivaceus, plerumque 7–10 cm. longus, sed in speciminibus rubustioribus, usque 16–18 cm. longus ; bracteae flores stipantes minutae, usque 2–3 mm. longae, deltoideae vel lanceolatae, purpureae, membranaceae. Inflorescentia (1)2-8(9)-flora, flores patentes vel subcernui ; pedicelli 5 mm. usque 15 mm. longi, purpurascentes. Perigonium concolore, saturate caeruleum, in alabastro anguste ellipsoideum, apice subacutum, basi in tubum rugulosum circiter 5–7 mm. longum et 4–5 mm. latum connatum ; perigonii segmenta primo patentia, postea valde recurvata ; tepala 3 exteriora lanceolata, circiter 1·2–1·3 cm. longa et 4·0 mm. lata, intus ad partem costae superiorem distincte cristato-alata, apice mucronulo papilloso coronata ; tepala 3 interiora exterioribus subaequilonga, sed circiter 5·0–6·0 mm. lata, parte costae superiore exalata, sine mucronulo apicali. Filamenta ad faucem affixa, inaequalia, 3 circiter 4·0 mm. longa et 3 circiter 3·0 mm. longa, erecta, applanata, ad apicem angustata, apice subacuta, nec dilatata nec emarginata, caerulea vel rarissime albida ; antherae circiter 4·5 mm. longae et 1·0 mm. latae, ad apicem sensim angustatae, basi et apice distincte bifidae, caeruleae. Ovarium ovoideum, circiter 4·0 mm. longum et 2·5 mm. latum, glabrum. Stylus circiter 2·0 mm. longus et 0·75 mm. latus, truncatus, stigma vix capitatus. Capsula immatura subglobosa, trigona, circiter 9·0 mm. diametro ; semina non visa.

Cyprus : Troodos, northern flank, near Spilia, 3,000–4,000 ft. alt., 13th March, 1953, *E. W. Kennedy* 1776 (type in herb. Kew) ; in the Pine forest, near a torrent. Same locality, 23rd April, 1953, *E. W. Kennedy* 1789 ; fruiting specimens ; in shade on North-facing bank of stream, under *Quercus alnifolia* and Pine trees. The young capsules mostly eaten. Pedhoulas, March, 1953, *E. W. Kennedy* 1781.

Bulbs of this charming *Chionodoxa*, the first member of the genus to be discovered in Cyprus, were collected by Lady Loch in the locality cited above, on 8th March, 1953, and forwarded to Kew by Mrs. E. W. Kennedy. The material was insufficient for precise determination, but sufficient to prove that the plant was a *Chionodoxa*, and therefore of considerable interest. Five days later Mrs. Kennedy visited the locality where Lady Loch had first found the plant, and forwarded an ample quantity of dried material for the Herbarium, together with additional bulbs for cultivation at Kew. This material showed that the *Chionodoxa* was an undescribed species, readily distinguishable from its allies in

having concolorous flowers ; blue anthers (sometimes masked by creamy-white pollen when the anthers have dehisced). The cultivated specimens are few-(1–3)-flowered, but Lady Loch remarks (*in lit.*) that 6–8-flowered specimens are usual in Cyprus, and that a plant with nine flowers has been collected. The cultivated specimens will probably flower more freely when better established. The individual flowers are larger than those of *C. sardensis* Drude and *C. luciliae* Boiss., and of a lovely bright blue, near to the colour of *C. sardensis* (R.H.S. Colour Chart 41/1) but perhaps a shade softer in tone.

The mature flowers of *C. lochiae* are nodding, as in *Scilla sibirica* Andr., not erect as in the majority of *Chionodoxa* species, and this feature adds considerably to the elegance of the plant.

Bulbs sent by Lady Loch and Mrs. Kennedy, and planted outside at Kew in 1953, survived the severe frosts of January 1954 without suffering the slightest injury, flowering freely during the first fortnight of March. *C. lochiae* is likely to be a valuable addition to the garden.

NOTES ON ASIATIC GRASSES : XIX.

New species and new names.

N. L. Bor

Agrostis nagensis *Bor*, sp. nov. cum *A. zenkeri* Trin. comparanda sed ab ea spiculis majoribus, glumis quam lemma longioribus et glumis praecipue inferiore acuminatis fere setosis facile distinguitur.

Gramen annuum. Culmi usque 100 cm. alti, laxi fere scandentes, tenues, teretes, laeves glabrique, nodis glabris. *Foliorum laminae* lineari-acuminatae, basi rotundatae, utrimque marginibusque scaberulae, planae, usque 12 cm. longa, 4 mm. latae ; *vaginae* complectentes, internodiis breviores, glabrae, nitentes, striatae, laeves vel minutissime scaberulae ; *ligulae* membranaceae, breves, 1–2 mm. longae.

Panicula effusa 11 cm. longa, 8 cm. lata, paucispiculata ; axis pertenuis, rectus, laevis glaberque ; rami nodis 3–4-nati, flexuosi, ternatim ramulosi, ut videtur laeves glabrique, pedicelli filiformes apice dilatati. *Spiculae* anthesi hiantes. *Gluma inferior* 3·5 mm. longa, 1 mm. lata, explanata lanceolato-acuminata, apice breve setosa, 1-nervis, carinata, carinae apicem versus scaberula ; *gluma superior* 3 mm. longa, 0·75 mm. lata, lanceolato-acuminata, ceterum inferiori similis. Anthoecium ♀ ; *lemma* cum callo 2·75 mm. longum, ovato-acutum, tenuiter 5-nerve, dorso laeve, glabrum ; *palea* 1·5 mm. longa, hyalina ; *stamina* 3 ; *antherae* 0·5 mm. longa ; *styli* 2 ; *stigmata* plumosa ; *rhachilla* penicillata.

Ind. Or. : Assam ; Naga Hills, Japvo, 2400 m., 28 Sept. 1935, *N. L. Bor* 6449—a straggling grass (typus in Herb. Kew.).

This species is conspicuously different from *A. zenkeri* Trin. (*A. abnormis* Munro) on account of the very long acuminate almost setose glumes. The texture of the lemma is altogether much more delicate and the anthers are smaller.

Deyeuxia hackelii *Bor*, sp. nov. *D. elatiori* proxima sed ab ea spiculis longioribus glumis acuminatis ramis longioribus panicula multo minore densiore distinguitur.

Gramen perenne, rhizomatosum. *Culmi* usque 90 cm. alti, erecti, teretes, laeves glabrique, nodis glabri. *Foliorum laminae* lineari-acuminatae, in apicem filiformem attenuatae, basi contractae vel paulo rotundatae, utrimque glabrae, marginibus scabrae, planae, scabrae vel laeves supra vel scaberrima ; *vaginae* culmos complectentes, striatae, glabrae, inferne scabrae, basales laxae a culmis solutae, scariosae ; *ligulae* membranaceae, 6 mm. longae, im apicem truncatum attenuatae.

Panicula oblonga, usque 18 cm. longa, 3 cm. lata, dense spiculata ; axis teres, scaber, nodosus ; rami nodis numerosi, 4 cm. longi, erecti, ramosi ; ramuli brevissimi. *Spiculae* lanceolatae, anthesi hiantes, purpureae, 6–7 mm. longae. *Gluma inferior* 6–6·5 mm. longa, lanceolato-acuminata, firmissima, carinata, dorso carinaque scabra, 3-nervis ; gluma superior similis, 3–5-nervis. *Anthoecium* ♀ ; *lemma* 5 mm. longum, 1·5 mm. latum, oblongo-ovato-acutum, membranaceum, dorso scabrum, 5-nerve ; *palea* elliptico-oblongo-truncata, 2-nervis, hyalina ; *stamina* 3 ; *antherae* 2–2·5 mm. longae ; *styli* 2 ; *stigmata* plumosa ; *rhachilla* producta, penicillata ; *arista* 4 mm. longa, antrorse scabra, inferne torta.

IND. OR. : Kashmir, Astor valley above Doian, 3300–3600 m., 14 Aug. 1892, *J. F. Duthie* 12454 (typus in Herb. Kew.).

Deyeuxia rosea *Bor* sp. nov., cum *D. pulchella* Hook. f. comparanda sed ab ea lemmati infra dorsum medium aristato, glumis roseis glabrescentibus recedit.

Gramen perenne. *Culmi* usque 35 cm. alti, teretes, simplices, 2–4-nodes, laeves glabrique. *Foliorum laminae* lineari acuminatae, glaucae, supra inter venos valde furcatae, marginibus scaberulae, 4–8 cm. longae, 4 mm. latae, im apicem validum attenuatae, utrimque scaberulae, adscendentes ; *vaginae* striatae, complectentes, laeves, glabrae ; *ligulae* membranaceae, 5–9 mm. longae.

Panicula congesta, 6–9 cm. longa, 1·7 cm. lata, interdum interrupta, purpureo-rosea ; axis scaberulus ; rami pedicellique breves, plus minus scaberuli. *Spiculae* 4·5–5·5 longae, 1-flores. *Gluma inferior* paulo longior superiore, 4·5–5·5 mm. longa, 1·75 mm. lata, explanata elliptico-acuminata, 1-nervis, carinata, dorso glaberrima, carina scaberula ; *gluma superior* similis. *Anthoecium* ♀ ; *lemma* 4·5 mm. longum, 1·6–1·8 mm. latum, membranaceum, elliptico-truncatum, 5-nerve, dorso scabrum, aristatum ; *arista* ex dorso medio emergens, 4–5 mm. longa ; *palea* hyalina, 3 mm. longa, anguste elliptica, 2-carinatum ; *styli* 2 ; *stigmata* plumosa ; *stamina* 3 ; *antherae* 2–2·5 mm. longae ; *rhachilla* 2 mm. longa, penicillata ; *pili* 2 mm. longi ; *callus* breve barbatus.

TIBET : Lhasa, 3,300 m., Sept. 1904, Capt. H. J. Walton, I.M.S. (typus in Herb. Kew.).

Erianthus wardii *Bor*, sp. nov. ab *Eriantho longisetoso* Anderss. panicula laxiore, racemis longioribus, spiculis minoribus, glumis omnino glabris, calli pilis duplo spiculis longioribus.

Gramen perenne caespitosum. *Culmi* usque 3 m. alti, teretes, laeves glabrique, nodis glabri. *Foliorum laminae* in apicem longe acuminatum attenuatae, ad basin contractae usque 1 m. longae, 2·5 cm. latae, glaucae, utrimque laeves glabraeque, marginibus scaberrimae ; *vaginae* complectentes, teretes, laeves, glabrae, sparsis pilis superne exceptis ; *ligulae* coriaceae, 2 mm. longae.

Panicula usque 20 cm. longa, 10 cm. lata ; axis 2–3-angulatus, angulis ciliatus, vel glaber laevisque ; racemi usque 10 cm. longi, multi articulati, fragiles. Spiculae ad quemvis rhacheos nodum binae, una sessilis, una pedicellata ; sessilis cum articulo accumbente pedicelloque demum decedens, pedicellata a pedicello demum soluta, utraque uniflora, a dorso leviter compressa, aristata ; rhacheos articuli graciles, leviter compressi, marginibus ciliati, spiculis longiores vel breviores ; pedicelli similes sed breviores. *Spiculae sessiles*, cum callo 0·5 mm. longo, 4–4·5 mm. longae ; calli pili 8–9 mm. longi, subpurpurei. *Gluma inferior* oblongo-acuta, chartacea bis coriacea, 5-nervis, nervis infra apicem anastomosantibus, dorso glaberrima, laevis, marginibus ciliata ; *gluma superior* 3·5 mm. longa, navicularis, 3-nervis, laevis glabraque, superne marginibus hyalinis ciliata. *Anthoecium inferius* vacuum ; *lemma* hyalinum, oblanceolatum, 3 mm. longum, marginibus ciliatum ; *palea* abest. *Anthoecium superius* ♀ ; *lemma* 3 mm. longum, angustum, hyalinum, marginibus ciliatum, apice breve fissum, aristatum ; *palea* minuta, hyalina, sparse margine superiore

ciliata ; *stamina* 3 ; *antherae* purpureae, 2·5 mm. longae ; *styli* 2 ; *stigmata* plumosa ; *lodiculae* 2, cuneatae, truncatae ; *arista* 20–25 mm. longa, haud vel leviter torta. *Spicula pedicellata* spiculae sessili similis.

Burma : North Triangle (Kamjaw), 900 m., 2 Dec. 1953 : a tall more or less erect reed-like grass, 15 ft. high. Forms large clumps in second growth, sunny slopes. *F. Kingdon-Ward* 21666 (typus in Herb. Kew.).

This grass would, at a superficial glance, be taken for a species of *Miscanthus* on account of the panicle of long open flexuous and drooping racemes. The rhachis of the raceme is, however, fragile, and one of the spikelets is sessile. It has some affinity with *Erianthus longisetosus* Anderss., but the panicle is much looser, with longer racemes, smaller spikelets and longer rhachis joints relative to the spikelets. The glumes, moreover, are entirely glabrous, the callus much more definite and the callus hairs are about twice as long as the spikelet, the anthers are smaller (2·5 mm. as against 3 mm.) and the palea of the upper floret is a minute scale as against a narrow scale 4 times as long.

Eulalia siamensis *Bor*, sp. nov. ab aliis speciebus hujus generis spiculis magnis, racemorum pilis subpurpureis, lana basale aurea differt.

Gramen perenne radice valida, ad basin lana aurea obtectum. *Culmi* usque 2 m. alti, teretes, solidi, infra inflorescentiam pedunculo pilosi, ceterum laeves glabrique, basi vaginis vetustis obtecti. *Foliorum laminae* lineari-acuminatae usque 1 m. longae, 1 cm. latae vel latiores, ad basin attenuatae, inferne supra dense pilis e tuberculis ortis obtectae, superne utrimque glabrae, tenuiter nerves, marginibus laeves vel scaberulae ; *vaginae* superne culmos complectentes, laeves glabraeque vel superne sparse pilosae, coriaceae ; basales tortae, laxae ; *ligulae* breves, coriaceae.

Racemi 5–7, terminales, digitati, violaceo- vel subpurpureo-pilosi. *Spiculae* ad quemvis rhacheos nodum binae, pedicellata neutra a pedicello demum soluta, sessilis hermaphrodita cum pedicello et articulo accumbente demum decidens, a dorso leviter compressa, aristata ; rhachis multi articulata, fragilis, pilis subpurpureis 4 mm. longis pilosa. *Spicula sessilis* ; callus 0·5 mm. longus ; *gluma inferior* 6 mm. long, 1·25 mm. lata, explanata anguste elliptica, apice bifida, dorso plana vel paulo convexa, 2-carinata, 2-nervis, carina dorsoque pilis subpurpureis dense pilosa ; *gluma superior* 6·5 mm. longa, navicularis, 3-nervis, aurea, apice aristulata, apicem versus carinata, carina scabra, inferne dorso pilosa. *Anthoecium inferius* vacuum ; *lemma* hyalinum, 5 mm. longum, oblongo-obtusum, marginibus ciliatum ; *palea* abest. *Anthoecium superius* ♂ ; *lemma* 3·5 mm. longum, apice breve bifidum, angustum, aristatum ; *palea* non visa ; *stamina* 3 ; *antherae* 4·5 mm. longa ; *styli* 2 ; *stigmata* plumosa ; *arista* valida usque 3·5 cm. long ; *columna* teres, torta, flexuosa 1·8 cm. longa ; *aristula* subplana, scabra, flexuosa, 1·7 cm. longa. *Spiculae pedicellatae* spiculis sessilibus similes ; anthoecia nulla ; lemma hyalinum, 5 mm. longum.

Siam : Doi Sutep, 450–1500 m., 11 Nov. 1911, *A. F. G. Kerr*, 2218—in tufts, growing to a height of 2·5 m. ; principal grass of open jungles (typus in Herb. Kew.) ; Chiengmai Doi Sutep, c. 1100 m., 3 Sept. 1948, *Plernchit* 29—grass with brown glumes.

This very distinct species of *Eulalia* appears to have a very local distribution since it has been collected in the single locality mentioned.

The extremely stout base is covered with a pale yellow to golden wool, while the racemes are decorated with mauve to pale reddish hairs. It really must be a magnificent grass.

Stipa chitralensis *Bor*, sp. nov. ab aliis speciebus indicis panicula congesta compacta differt.

Gramen perenne rhizomatosum. Culmi erecti, usque 40 cm. alti, omnino vaginis obtecti, laeves glabresque, valide striati, nodis glabris. *Foliorum laminae* duorum generum, eae innovationum longiores usque 25 cm. longae, 2·5 mm. latae, flexuosae involutae vel convolutae, apicibus filiformes, utrimque laeves glabraeque, marginibus scabrae, eae culmorum firmiores, latiores, erectae, usque 22 cm. longae, 6 mm. latae, utrimque laeves glabraeque ; *vaginae* breves, striatae, laxae, inferne coriaceae nitentes, eae culmorum complectentes, laeves glabraeque, auriculis ciliatis ; *ligulae* membranaceae, brevissimae, truncatae, 1·5 mm. longae.

Panicula congesta 9 cm. longa, 2 cm. lata ; axis laevis, glaber, striatus ; rami breves, laeves glabrique ; ramuli brevissimi, similes. *Spiculae* breve pedicellatae, 9·5 mm. longae, lanceolatae, nitentes, aristatae. *Gluma inferior* 8 mm. longa, explanata 2·5 mm. lata, oblonga, acuta, hyalina, nitens, glaberrima, laevis, 3-nervis, nervis lateralibus cum mediano anastomosantibus ; *gluma superior* 8·5 mm. longa, 2 mm. lata, explanata oblongo-acuta, 5-nervis. *Lemma* cum callo obtuso barbato. 0·5 mm. longo, 9·5 mm. longum, 2·5 mm. latum, membranaceum, 5-nerve, apici bifidum, (lobi 2·5 mm. longi, hyalini, laeves glabrique) dorso pilis 2 mm. longis pilosum ; *palea* 9 mm. longa, 2-nervis, inter nervos pilosa, membranacea ; *stamina* 3 ; *antherae* 6 mm. longae ; *styli* 2 ; stigmata plumosa ; arista cum nervo mediano articulata, 2 cm. longa ; columna 6 mm. longa, leviter torta, antrorse scabra ; *lodiculae* 2, angustae, lineari-acutae.

Ind. Or. : Chitral, Guger, c. 3000 m., 18 May 1895, Surgeon Lt. Harris 16800 (typus in Herb. Kew.).

Stipa munroana *Bor*, sp. nov. cum *S. splendente* Trin. comparanda sed ab ea spiculis majoribus, lemmatibus sparse haud dense pilosis, arista torta haud recta facile distinguitur.

Lasiagrostis robusta Munro in Cat. Griffith Falconer and Helfer's plants 56 (1865) nomen nudum.

Gramen, ut videtur, perenne. *Culmi* 1 m. alti vel altior, validi, teretes, glabri. *Foliorum laminae* lineares, acuminatae, involutae, usque 60 cm. longae, 5 mm. latae, supra scaberrimae, infra laeves glabraeque ; *vaginae* glaberrimae laeves, complectentes, striatae ; *ligulae* membranaceae vel chartaceae, 10 mm. longae.

Panicula laxa, effusa, nutans, 20 30 cm. longa ; axis teres vel angulatus, inferne laevis glaberque superne scabrescens multinodis ; rami 3–4-nati, usque 10 cm. longi, inferne nudi, superne spiculas congestas gerentes. Spiculae 9–9·5 mm. longae, teretes, quam pedicellos longiores. *Gluma inferior* lineari-lanceolata, acuta, 7 mm. longa, dorso scabra ; *gluma superior* 9–9·5 mm. longa, lineari-lanceolata, acuta, 3-nervis, dorso scaberula. *Lemma* 8·5 mm. longum, apici fissum, lobis

lateribusque pilosum ; callus obtusus ; palea hirsuta, 6 mm. longa, 2-nervis, inter nervos sparse pilosa, pilis albis ; *stamina* 3 ; *antherae* 4–4·5 mm. longae, apicibus barbatae ; *arista* 9–10 mm. longa, glabra ; columna 6·5 mm. longa, paulo torta.

AFGHANISTAN : Siah Sung, West Hindu Kush, 3–3,500 m., Griffith 1066 (typus in Herb. Kew.).

There is one sheet of this magnificent grass at Kew. It has no base but from its robust nature one could assume that it is a perennial. Griffith indeed mentions in his Itinerary Notes, 306 (1848) under the number 1066 " Gramen—Caespitos coarse, glauce 3–5 pedal panicula nutant. Above Siah Sung on the Shingly road.".

Poa afghanica *Bor*, sp. nov.

Gramen perenne rhizomatosum. *Culmi* erecti, basi paulo curvati, usque 60 cm. alti, laeves glabrique, teretes, striati, nodis glabri. *Foliorum laminae* usque 10 cm. longae, 5 mm. latae, eae innovationum angustiores et longiores, lineares, acutae, utrimque glabrae, marginibus scabrae, virides, planae ; *vaginae* culmorum complectentes, striatae, scaberulae, basales scariosae, a culmis solutae; *ligula* membranacea, lacerata, 1·5 mm. longa.

Panicula pyramidalis, 13 cm. longa, 12 cm. lata ; axis laevis glaber ; rami inferiores ternati, ad nodos superiores bini, inferiores usque 6 cm. longi, eorum dimidia pars inferior sine spiculas, divergentes, demum declinati, scabri, glabri. *Spiculae* ovato-acutae, 4–5-flores, hiantes, 6 mm. longae. *Gluma inferior* 2 mm. longa, 1·0 mm. lata, explanata ovato-acuta, 1-nervis, laevis glabraque, purpurascens ; *gluma superior* 2·5 mm. longa, explanata 2 mm. lata, ovato-acuta vel late elliptico-acuta, purpurascens. *Lemma* 3·5–4 mm. longum, 2 mm. latum, explanatum oblongo-obtusum vel oblongo- paulo obovato-obtusum, marginibus apicique hyalinum, purpureum, nervis lateralibus medianoque ciliatum : *palea* 3 mm. longa, carinis scabra ; stamina 3 ; *antherae* 2·75 mm. longae ; *stigmata* 2, plumosissima ; *rhachilla* scabra ; *lana* adest, sparsa.

AFGHANISTAN : Nuristan, Chetras, 3100 m., 30 May 1948, *L. Edelberg* 0851 (typus in Herb. Køb.).

This plant was collected on the 3rd Danish Expedition to Central Asia, in the mountainous country to the north-east of Kabul, not far from the Pakistan frontier. It differs from *P. pratensis* Linn., which it somewhat resembles, by the much longer anthers, very sparse wool ; the lemmas, too, have not got that granular appearance which is so marked in *P. pratensis* Linn.

Triplopogon ramosissimus (*Hack.*) *Bor*, comb. nov.

Ischaemum ramosissimum Hack. in DC. Monogr. Phan. **6,** 249 (1889).

I. spathiflorum Hook. f., Flor. Brit. Ind. **7,** 138 (1896).

Sehima spathiflorum (Hook. f.) Blatt. et McCann in Journ. Bomb. Nat. Hist. Soc. **32,** 23 (1927).

Triplopogon spathiflorus (Hook. f.) Bor in Kew Bull. **1954,** 54 (1954).

The type sheet of *Ischaemum ramosissimum* Hack. was obtained from Vienna through the kindness of Prof. Dr. H. Rechinger. Surprisingly it turned out to be the same species as *Ischaemum spathiflorum* Hook. f. which was taken as the type of a new genus *Triplopogon*, by the writer

[Kew Bull. 1954, 51 (1954)]. It is to be regretted that a new combination has to be made so soon, but there are extenuating circumstances.

Hügel's no. 1977 is a portion of the inflorescence of a mature specimen of the grass. The three tufts of hair which are such a conspicuous feature in the young spikelet, have fallen, and the description itself is most incomplete. How Hackel decided the grass was over 1·5 m. tall, from the fragment on the sheet, is a mystery. Presumably he had at his disposal some notes from the hand of Hügel.

Further, the distribution given by Hackel, " Asia (Hügel in H. Vindob. sine dubio ex Ind. or.) was not sufficiently precise or definite to call for a check of the type earlier.

Agrostis sikkimensis *Bor*, nom. nov.

A. divaricata Griseb. in Goett. Nachr. 82 (1868) non Hoffmann, Deutschlands Flora **1,** 37 (1800).

Sporobolus collettii (*Hook. f.*) *Bor*, stat. nov.

S. coromandelianus Kunth var. *collettii* Hook. f. Flor. Brit. Ind. **7,** 253 (1896).

An annual grass. Culms very slender, erect, terete, smooth and glabrous, striate, glabrous at the nodes. *Leaf-blades* up to 5 cm. long, 5 mm. wide, rounded at the base to the sheath, linear-lanceolate in outline, the lower flat, garnished on the margins with long stout tubercle-based hairs, scabrid on the margins, glabrous and smooth on both surfaces ; the upper rolled, twisted or folded in various ways ; *sheaths* tight, clasping the stem, smooth and glabrous, striate with ciliate auricles ; *ligule* not more than 1 mm. long, membranous, minutely ciliate on the upper margin.

Inflorescence a pyramidal panicle, consisting of a central axis 3–8 cm. long, distinctly noded, terete, striate, glabrous, smooth ; nodes gradually decreasing in length from below upwards, the lowest about 1 cm. long or a little longer, the uppermost 2–3 mm. long ; branches horizontal or slightly deflexed, drooping at the tips, 5–8 cm. long, 5–8 at each node, conspicuously bare in the lower half, sparsely branching and carrying reddish spikelets in the upper half. *Spikelets* 1·2 mm. long, widely gaping at anthesis, reddish-brown in colour. *Lower glume* 0·8–1 mm. long, very narrow, almost subulate in outline, when flattened narrowly lanceolate-acuminate, 1-nerved ; *upper glume* 1·25–1·5 mm. long, broadly ovate-acute when flattened, curved on the back, smooth and labrous, 1-nerved. *Floret* ♀ ; *lemma* similar in shape and size to the upper glume, but more delicate in texture ; *palea* also similar in shape but far more delicate, 2-nerved ; stamens, stigmas and styles not seen ; *grain* orbicular in outline, 0·75 mm. long, 4-angled.

Burma : Shan Hills, Meiktila, Sept. 1888, *H. Collett* (typus in Herb. Kew.).

This species in spikelet size and shape of seed is extremely close to *Sporobolus tetragonus* Bor, but the habit is quite different. The small, compact pagoda-like panicle is in complete contrast to the diander-like panicle of the other, and there is no doubt that they are specifically distinct.

This grass is obviously related in no way whatever to *S. coromandelianus* Kunth, of which Hook. f. made it a variety. The two species are easily separated by the shape of the seed.

THE GENUS POLYCARPAEA IN EAST AFRICA.

W. B. Turrill

Five species of *Polycarpaea* have been accepted in the account of the *Caryophyllaceae* prepared for the Flora of Tropical East Africa. Two of these have apparently not been previously described and named. To establish their proposed names according to the present rules of nomenclature, Latin descriptions are published below. In addition, it has been found necessary to transfer a variety from one species to another.

Polycarpaea eriantha [*Hochst. ex*] *Rich.* var. **effusa** (*Oliv. emend. Pax*) *Turrill.*

The var. *effusa* was placed by Oliver (Fl. Trop. Afr. **1,** 145 : 1868) under the species *P. corymbosa* (L.) Lam. and was originally based on four specimens. Of these, two (Zambesi, *Kirk* and Madi, *Speke and Grant*) are *Polycarpaea eriantha* [Hochst. ex] Rich. var. *eriantha*. Pax (Engl. Bot. Jahrb. **17,** 590 : 1893) quotes only the other two specimens, or corresponding specimens of the same origin (Niger, *Barter* and Angola, *Welwitsch*). These have glabrous sepals and are so described by Pax, though his measurement of 3 mm. is too long. One has to accept Pax's limitation (emendation) of the var. *effusa* to plants with glabrous sepals, even on transferring the variety from *P. corymbosa* to *P. eriantha*.

Suessenguth, in Trans. Rhod. Sci. Assoc. **43,** 9 (1951), described *Polycarpaea rhodesica* as a new species from S. Rhodesia, Marandellas. From the somewhat meagre description and from the isotype (*G. Dehn* 766) in Herb. Kew., this is *P. eriantha* var. *effusa*.

It is obvious, from material at Kew, that *P. eriantha* var. *effusa* has a wide range in Tropical Africa, since specimens have been collected in the Gold Coast, Nigeria, Angola, S. Rhodesia, N. Rhodesia, and Tanganyika. In some characters *P. eriantha* var. *effusa* resembles *P. brasiliensis* Cambess. var. *ramossima* Cambess. in A. St. Hil. Fl. Bras. Mar. **2,** 183 (1829). This, however, has 5 to 6 ovules per ovary (as against 2–3 in *P. eriantha*, including its var. *effusa*), as indicated in the description and checked from flowers dissected at Kew, and there are also other, less easily described, differences.

In their recent expedition to East Africa, Drummond and Hemsley collected material of a *Polycarpaea* which is tentatively placed in *P. eriantha* var. *effusa*. It has the effuse or expanded inflorescence, glabrous sepals, and strongly recurved capsule valves characteristic of the variety. It has, however, smaller flowers and it remains doubtful whether or not it is genetically distinct from var. *effusa* for which *Barter*, Niger, in Herb. Kew. is here accepted as the type. The collectors details are : Tanganyika : Tanga district, Moa, coconut grove near wells, 4 Aug. 1953, *Drummond and Hemsley* 3644. Annual herb, height to 20 cm. Flowers silvery white.

Polycarpaea grahamii *Turrill*, a *P. corymbosa* (L.) Lam. foliis anguste oblanceolatis praecipue distinguitur.

Herba annua, 2–3 dm. alta. *Caules* a basi ramosi, teretes, dense hirsuti. *Folia* caulina anguste oblanceolata, apice rotundata, basi gradatim angustata, 4–10 mm. longa, 1·5–2·5 mm. lata, in pagina

abaxiale plus minus hispida, adaxiale leviter hirsuta vel glabrescentia ; stipulae anguste lanceolatae, acuminatae, 2–3 mm. longae, scariosae. *Cymae* terminales, plus minusve congestae, multiflorae ; bracteae ad stipulas scariosas acuminatas saepissime connatas reductae ; pedicelli 0·5–4 mm. longi. *Sepala* 5, anguste lanceolata, acuta vel breviter acuminata, 3·5 mm. longa, 1·25 mm. lata, glabra, scariosa, uninervia, margine minute denticulata. *Petala* 5, angustissime lanceolata, apice irregulariter dentata vel emarginata, 2 mm. longa, tenuissima. *Stamina* 5, 1·75 mm. longa. *Ovarium* late ovoideum, 0·75 mm. altum, glabrum, ovulis circiter 18–20 instructum ; stylus tenuis, 0·75 mm. longus.

KENYA : Fundi Isa, 1929, *R. M. Graham* 1617. Herb, flowers white and dry. Grows in sand in bush near the shore. (Holotypus in Herb. Kew.).

This interesting and apparently very distinct species is especially characterized by its annual duration with well-marked tap-root, erect or somewhat ascending branches, some of which arise from the base of the aerial system, and narrowly oblanceolate leaves. Attention is also called to the peculiar appearance of the leaf venation as seen in boiled up herbarium material. This requires investigation from living plants.

Polycarpaea tenuistyla *Turrill* sp. nov. a *P. corymbosa* (L.) Lam. petalis anguste lanceolatis 2·3 mm. longis, staminibus 2 mm. longis, stylo 1·5 mm. longo facile distinguitur.

Herba perennis (?), a basi ramosa, caulibus inferne lignosis vel sublignosis usque ad 2.2 dm. longis dense foliatis, internodis saepissime 0·5–1·0 cm. longis hirsutis. *Folia* opposita vel verticillata vel pseudoverticillata, in ramis axillaribus dense aggregata, anguste linearia, acuta, mucronata, 3–11 mm. longa, 0·25 mm. lata, patula, glabra vel fere glabra ; stipulae anguste lanceolatae, acuminatae, circiter 2 mm. longae. *Cymae* terminales, 2–4·7 cm. latae, multiflorae. *Sepala* lanceolata, acuta vel breviter acuminata, 3 mm. longa, glabra. *Petala* anguste lanceolata, apice acuta vel irregulariter 2–3-dentata, 2·3 mm. longa, rubra (?). *Stamina* 2 mm. longa ; antherae 0·5 mm. longae. *Ovarium* 10–12-ovulatum ; stylus tenuis, 1·5 mm. longus.

KENYA. Kilifi District : Ribe to Galla Country, (received) May 1880, *Rev. T. Wakefield*. (Holotypus in Herb. Kew.).

This sheet, of three separate pieces, was filed under *Polycarpaea corymbosa*. It is true that *P. corymbosa* is a very variable species, especially in the degree of density of the inflorescence. Though the habit of *P. tenuistyla*, as shown by the type material, is different from that of most specimens of *P. corymbosa* in the possibly perennial duration and the short internodes with crowded leaves, approximations to the general appearance can be found in some plants of the widely ranging species. It is in the floral structure that there are characters which have not elsewhere been found in the numerous specimens examined : the relatively long narrow petals, the longer stamens with larger anthers, and the slender style. *P. angustipetala* Perrier de la Bathie, in Notulae Systematicae **14,** 53 (1950), from Madagascar, appears, *e descriptione*, to show some important resemblances to *P. tenuistyla*. It is, however, stated to have the petals a little longer than the sepals, smaller anthers, and style 1 mm. long.